

APPENDIX- I

Table 1: Technology at a glance for application in rural areas in India

Sl. No.	Technology / Material	Brief description	Technology specification	Innovator / Source	Market potential
Environment-Friendly, Energy Efficient, Cost-Effective Composite Materials/Products for Low Cost Housing					
1	Bamboo Mat Board (BMB)	Technology for manufacturing Bamboo Mat Board (BMB) of durable, strong, water-proof, and decay-insect-fire resistant. The material is useful for multipurpose utilities including as low cost composite materials of environment friendly, energy efficient for house construction.	Bamboo Mats, woven in herringbone or rectangular pattern are soaked in resin incorporated with preservative chemical. Resin soaked mats are dried, assembled in 2-7 layers according to required thickness and hot pressed. Finally boards are cut to required sizes. Raw material: Abundantly available bamboo grass <i>Meleanca baccifera</i> , polymeric resin, chlorinated hydrocarbons and boron and cashew nut shell liquid.	Indian Plywood Industries Research and Training Institute (IPIRTI) http://www.ipirti.gov.in Building Materials & Technology Promotion Council, Ministry of Housing & Urban Poverty Alleviation, Government of India http://www.bmtpc.org	Conventional building technologies like burnt bricks, steel and cement are high in cost, utilize large amount of non-renewable natural resources like energy, minerals, top-soil, forest cover etc. These increase dependence on external materials and manpower, harm the local economy and are generally polluting in nature. This environment-friendly technology replaces wood / plywood and saves forests upto

		<p>Application: Flooring, walling, structural membrane, false ceiling, door and window frames.</p> <p>Standard: IS:13958:1994</p> <p>Status: Commercialized</p> <p>Investment: Rs. 202 Lakh (Unit capacity 129000 sheets per year)</p>		<p>the extent of 25%. Substitution of plywood with BMB results in saving 30000 Ha of forests every year. Due to low cost, good market potential both in rural and urban areas.</p>
<p>2</p> <p>Bamboo Mat Veneer Composite (BMVC)</p>	<p>Technology for manufacturing Bamboo Mat Veneer Composite (BMVC) of durable, strong, water-proof, and decay-insect-fire resistant. The material is useful for multipurpose utilities including as low cost composite materials of environment friendly, energy efficient for house construction.</p>	<p>Resin coated bamboo mats, woven in herringbone pattern using slivers of about 0.6 mm thickness, and rotary cut veneers from plantation wood are used for manufacture Bamboo Mat Veneer Composites.</p> <p>Raw material: Plantation wood, bamboo plant, plantation wood veneer, bamboo mat, polymeric resin, chlorinated hydrocarbons, boron and cashew nut shell liquid.</p> <p>Application: Door skin in flush doors and structural usage as roofing, web construction, prefab and portable shelters, packing, modular partitions and furniture etc.</p> <p>Standard: IS:14588/1999</p>	<p>-do-</p>	<p>The material is environment-friendly, energy efficient, cost-effective composite materials/products for low cost housing and good market potential both in rural and urban areas.</p>

Status: Commercialized

Investment:-

3

**Bamboo
Corrugated
Roofing Sheet**

Technology for manufacturing Bamboo Corrugated Roofing Sheets which is useful for roofing sheets as a substitute to corrugated asbestos cement sheets, galvanized iron sheets, aluminum sheets and fibre-reinforced Plastic (FRP) sheets. Some of the other advantages are viz., protection against UV light and improved impermeability to water etc.

A technological design of sinusoidal wave patterns using bamboo mat coated with suitable resin binder.

Raw material: Bamboo grass *Meleannca baccifera*, polymeric resin, chlorinated hydrocarbons, boron, cashew nut shell liquid etc.

Application: Roofing sheets as a substitute to corrugated asbestos cement sheets, galvanized iron sheets, aluminum sheets and fibre-reinforced Plastic (FRP) sheets.

Standard: IS: 15476:2004 formulated with BIS

Status: A Pilot Production Unit for manufacture of sheets has been set up in Meghalaya with production capacity of 3000 sheets per month.

-do-

The material is environment-friendly, energy efficient, cost-effective composite materials/products for low cost housing. It has also some advantages like protection against UV light and improved impermeability to water. Good market potential both in rural and urban areas.

4

Phosphogypsu

Technology for manufacturing Phosphogypsum Panel from the

Phosphogypsum is produced as a by-product in the manufacture of

Central Building Research

The technology utilizes byproducts largely generated in

<p>m Panel</p>	<p>byproducts of phosphoric acid available abundantly in hydrofluoric and phosphoric acid industry and fertilizer industries.</p>	<p>phosphoric acid. The purified phosphogypsum has been utilised in the production of fibrous plaster boards, building blocks, slotted tiles, making super sulphated cement and high strength alpha plaster.</p> <p>Raw material: By-products like phosphogypsum / flouro-gypsum, water, hot aqueous ammonium sulphate and sulphuric acid silica mixture etc.</p> <p>Application: Gypsum plaster and plaster products like plaster boards, blocks, bricks, tiles, roofing, walling, panels and false ceiling tiles etc.</p> <p>Standard:-</p> <p>Status:-</p> <p>Investment:-</p>	<p>Institute (CBRI), Roorkee.</p> <p>Building Materials & Technology Promotion Council, Ministry of Housing & Urban Poverty Alleviation, Government of India</p> <p>http://www.bmtpc.org</p>	<p>hydrofluoric and phosphoric acid industry and fertilizer industries therefore, one way environment friendly and due to low cost has good market potential both in rural and urban areas.</p>
<p>5</p> <p>Jute Polyester Composite</p>	<p>Technology for manufacturing Jute Polyester Composite from woven jute fibres and polyester amide polyol for utilization as composite materials like chip boards, roofing sheets, door</p>	<p>Raw material: Woven jute fibres and polyester amide polyol as interfacing agent.</p> <p>Application: Chip boards, roofing sheets, door shutters, partition</p>	<p>Building Materials & Technology Promotion Council, Ministry of Housing & Urban Poverty Alleviation, Government of India</p>	<p>The material is environment-friendly, energy efficient, cost-Effective composite materials/products for low cost housing</p>

	shutters, partition panels and door/window frames etc. in construction of low cost house.	panels and door/window frames etc. http://www.bmtpc.org		
		Standard:		
		Status:		
		Investment:		
6	Technology for manufacturing Coir Composite Board which is useful as medium density fibre boards as a wood substitute for paneling, cladding, surfacing and partitioning and door/window shutters etc..	Raw material: Coconut (naturally abundant in Coastal Regions), core fibres, mineralized water, cashew nut shell liquid and para formaldehyde etc. Application: Medium density fibre boards as a wood substitute for paneling, cladding, surfacing and partitioning and door/window shutters etc.	-do-	The material is environment-friendly, energy efficient, cost-Effective composite materials/products for low cost housing
	Coir Composite Board	Standard:		
		Status:		
		Investment:		
7	The material is useful for warehouses, false ceilings, insulation, partition and stage settings, industrial and domestic floorings.	Raw material: Bamboo grass, rice husk, bamboo mat, cashew nut shell liquid and phenolic resin etc. Application: Warehouses, false ceilings, insulation, partition and stage settings, industrial and	-do-	The material is environment-friendly, energy efficient, cost-Effective composite materials/products for low cost housing
	Bamboo-Rice Husk Composite	Standard:		
		Status:		
		Investment:		

domestic floorings.

Standard:

Status:

Investment:

8	The material is useful for partitions, door shutters and roofing sheets etc.	Raw material: Red-mud, jute fabric and polymeric binder etc. Application: Partitions, door shutters and roofing sheets etc. Standard: IS: 4020 Status: Commercialized; Product tested and approved by CPWD, IIT Chennai and Delhi. Investment:	Regional Research Laboratory, Bhopal. Building Materials & Technology Promotion Council, Ministry of Housing & Urban Poverty Alleviation, Government of India http://www.bmtpc.org	The material is environment-friendly, energy efficient, cost-Effective composite materials/products for low cost housing
9	The material can be utilized as filler walls, in-situ cellular, walls and partitions as a good insulator at roof tops for reduction of heat load in buildings. The densities concrete blocks ranging from 400 kg/m ³ to 1800 kg/m ³ .	Raw material: Fly ash (from coal based power generating plants), cement, sand, water and foaming agent etc. Application: Filler walls, in-situ cellular, walls and partitions as a good insulator at roof tops for reduction of heat load in buildings. The densities concrete blocks	Building Materials & Technology Promotion Council, Ministry of Housing & Urban Poverty Alleviation, Government of India http://www.bmtpc.org	The material is environment-friendly, energy efficient, cost-Effective composite materials/products for Low Cost Housing

**Red-Mud
Polymer Jute
Composite**

**Cellular Light
Weight
Concrete Block**

		ranging from 400 kg/m ³ to 1800 kg/m ³ .		
		Standard:		
		Status:		
		Investment:		
10	The material can be utilized as medium density fibre boards, partitions, door shutters and furniture etc.	Raw material: Waste from cotton plants waste, cashew nut shell liquid, para formaldehyde etc.	-do-	The material is environment-friendly, energy efficient, cost-Effective composite materials/products for Low Cost Housing
	Cotton Stalk Composite	Application: Medium density fibre boards, partitions, door shutters and furniture etc.		
		Standard:		
		Status:		
		Investment:		
11	The material is useful for flooring, walling and partitions.	Raw material: Bamboo plant, wood, bamboo mat, waste wood chips and polymeric resin etc.	-do-	The material is environment-friendly, energy efficient, cost-Effective composite materials/products for Low Cost Housing
	Bamboo Laminated Composite	Application: Flooring, walling and partitions.		
		Standard:		

Status:**Investment:****12****Matt Glazed
Ceramic tiles
for flooring and
wall facing**

The technology is highly cost effective as it utilizes locally available machinery and low grade cheaper raw materials. The product developed by this process can also be used for interior and exterior decoration of buildings and various other purposes.

The product obtained by this process has fired strength of around 40 N/mm², water absorption at 1150-1180°C is 0.5% to 1% and impact strength 0.02-0.04 kgfm/cm.

Raw material: Locally available Plastic clays, low grade clays, additives and glazes.

Application: Tiles for flooring, wall facing, interior and exterior decoration of buildings and various other purposes.

Standard: The crazing resistance conforms to IS: 2838-1964.

Status: The process has been developed on a semi commercial scale.

Investment: Rs. 10 lakh.

Central Glass & Ceramic Research Institute, Khurja, Calcutta, India

National Research Development Corporation (A Government of India Enterprise) 20-22, Zamroodhpur Community Center Kailash Colony Extension New Delhi 110 048. India

Tel: 91-11-26419904, 26417821, 26480767, 26432627; Fax: 011-26231877, 26460506, 26478010

Website: www.nrdcindia.com

These tiles can also find vast market in low cost housing for rural population. The advantages of the technology are that it is less capital intensive and therefore, suitable for low and medium scale manufacturer, consumes less energy resulting low cost of production, suitable for low grade cheaper raw material and utilises locally available machinery.

13**Clay Roofing
Tiles**

Mangalore pattern clay roofing tiles, named after the place in Karnataka, are interlocking

These tiles are extremely popular in the coastal states and possess a uniform texture and colour, a

Central Building Research Institute, Roorkee

These tiles can also find vast market in low cost housing for rural population. The

type with ribs and lugs to rest on battens.

Raw material: Mainly Alluvial soils.

Application: Roofing tiles of cheapest and durable and useful for the southern part of rural areas.

Standard: Tests carried out in accordance with IS specifications has shown that the breaking load is 110-190 kg for AA class and 90-110 kg for A class, while water absorption is 12-14 and 14-16% respectively.

Status: Commercialized.

Investment: Rs. 675/1000 AA class tiles and 600-650/1000 A class tiles depending on the place.

advantages of the technology are that it is less capital intensive and therefore

14

Clay Flooring Tiles

Clay flooring tiles form one of the cheapest and most durable building materials in rural houses. Tiles conventionally manufactured in northern India from alluvial soils show high water absorption and poor impact and abrasion resistance.

These flooring tiles can be produced in three sizes viz., 150 x 150 x 15 mm; 200 x 200 x 20 mm and 250 x 250 x 25 mm. The tiles possess uniform texture and colour, a metallic sound and good finish.

Raw material: Mainly Alluvial soils.

-do-

These tiles can also find vast market in low cost housing for rural population. The advantages of the technology are that it is less capital intensive and therefore

Application: Flooring tiles of cheapest and durable and useful for the southern part of rural areas.

Standard: Flexural strength, water absorption and abrasion resistance accord with the IS specifications for first class tiles.

Status: Commercialized.

Investment: Rs. 1 lakh for production of 2500 tiles/day.

15

Fire Retardant Thatch Roof

Most of the villagers live in huts and mud houses with thatched roofs. These roofs need constant maintenance and renewals nearly every year. The greatest hazard associated with such roof is that in summer months these roofs are prone to catch fire easily. The fire from a burning hut could spread to a group of huts or even to the whole village itself. These roofs are not hazard-free in rainy season also as rain water leaks through them.

The life of the improved thatched roof is 4 – 5 years as against about a year of the traditionally made thatched roof. The roof is rendered leak-proof and fire-retardant.

Raw material: Paddy straw, coconut/palmyra/reeds leaves.

Application: Improved roofs from thatch as construction material for house building.

Standard: -

Status: Commercialized.

-do-

The technology is highly labour intensive and can easily be learned by the villagers themselves. Vast market potential as housing material for rural population as the technology is less capital intensive.

Investment: Rs. 32/sq meter

(Rs. 5/sq.m).

16

Low Cost Rural Housing

The need for low cost houses has assumed significance in view of increasing cost of RCC structures and prevalent poverty in the rural areas. The various civil engineering based research institutions of the country have developed alternatives building materials and construction technologies to reduce the cost of construction.

Model I: Brick panel roofing with water proofing course, country burnt bricks in mud mortar walls, frameless doors with cheap local wood hinged at top and bottom, rubble stone in mud mortar plinth and kutcha flooring, sanitary latrine and water disposal.

Model II: Mangalore (burnt clay) tiles on rafters and purlins roofing; burnt brick in mud mortar wall, cheap wood door, brick jali for window, kutcha flooring and rough stone in mud mortar and hammer dressed stone in mud mortar plinth with sanitary latrine and water

National Organization, Bhavan, New Delhi

Building Nirman

The cost of the housing is within the reach of the rural poor and it ranges from Rs. 30 - 50 / per sq. ft. depending upon the availability of the materials

drainage.

Model III: 10 cm thick stone slabs with 10 cm thick lime terracing roofing, babul wood doors and windows, stone masonry in mud mortar wall, 7 cm thick stone slab flooring, stone masonry plinth with sanitary latrine and water drainage.

Building technologies for sustainable livelihood

<p>17</p> <p>Concrete Block</p>	<p>This technology offers a speedier, cost effective, environmentally sound alternative to conventional walling materials. Concrete blocks can be used like any other masonry unit to build foundations, walls, arches and corbels, etc. A typical concrete block is equivalent to 4.5 bricks, thus construction is faster than with other masonry units.</p>	<p>The specifications and the characteristics of a concrete block depend on the machine used to manufacture concrete blocks. The most common size of solid concrete blocks is 300x200x150mm. Weight of a concrete block is about 18-19 kgs. Concrete blocks can be surface engineered by using pieces of stone or ceramic waste on their face.</p> <p>Raw material: Cement, fine aggregate and coarse aggregate. Very little water is used.</p> <p>Application: Concrete blocks can</p>	<p>IIT, Chennai, Construction Management Division, Dept of Civil Engg, Adyar, Chennai (TN) Ph: 044-2351365, Fax:044-2350509</p> <p>CBRI , Roorkee , Central Building Research Institute, Roorkee - 247667 (UP) Ph.No: 01332 - 72243 Fax No: 72273</p>	<p>It is an effective means of utilizing wastes generated by stone crushers, quarrying and stone processing units. The technology has high potential in areas where raw materials are easily available. The Concrete Block Technology package is a highly profitable business for micro and small scale building material producers and construction companies. A total investment of about Rs.1,75,000/- assures a net profit of approximately Rs. 60,000/- per annum. The</p>
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be extensively used in combination with conventional roofing systems like RCC, RBC, GI sheets, ACC sheets etc. They are also compatible with other materials like fired bricks, dressed stone and compressed earth blocks for composite wall construction.

Standard: IS: 2185, 1979

Status: The Concrete Block Technology package has been adapted by Development Alternatives with financial support from Swiss Agency for Development Cooperation.

Investment: Rs.1,75,000/-

market for concrete blocks is growing at a rapid rate, especially in the areas where burnt bricks are not easily available or are of poor quality.

18

Compressed Earth Block (CEB)

It is a type of manufactured construction material formed in a mechanical press that forms an appropriate mix of dirt, non-expansive clay, and an aggregate into a compressed block. CEB blocks are installed onto the wall by hand and slurry made of a soupy version

The Stabilised Compressed Earth Block is a masonry unit of cuboidal shape. This may be solid/hollow/interlocking. The shape and size of a block is defined by the equipment used in its manufacture.

Raw material: Raw earth or soil, OPC cement in small quantities, water and are other constituents.

Building Materials & Technology Promotion Council, Ministry of Housing & Urban Poverty Alleviation, Government of India
<http://www.bmtpc.org>

The Compressed Earth Block technology package is a profitable business for micro and small scale building material producers and construction companies. A total investment of approximately Rs. 1,00,000/- for a manual scale production unit yields a

of the same dirt/clay mix, sans aggregate, is spread or brushed very thinly between the blocks for bonding. There is no use of mortar in the traditional sense. The advantages of CEB are that it is non-toxic, sound, fire, insect and mold resistance. Construction method is simple. Less skilled labor is required; wall construction can be done with unskilled labor encouraging self-sufficiency and community involvement.

Coarse sand or stone dust may be added depending on soil quality.

Application: SCEBs can be used for load bearing construction up to 3 storeys.

Standard: B.I.S code IS 1725, 1982 and tested in accordance with IS 3945- 1992.

Status: Commercialized; In India more than 5 million Stabilised Compressed Earth Blocks have been used to build residential and community buildings in both urban and rural areas. The benefits of this technology have been appreciated by the public sector and it is being promoted by HUDCO's network of building centres to build public sector housing and institutional projects. The Compressed Earth block technology package has been developed with initial support from Department of Science and Technology, Govt. of India and financial support from the Swiss

net profit of Rs. 70,000/- per annum; while an investment of Rs.6,50,000/- lakhs in a mechanised unit can yield up to Rs. 2,50,000/- per annum after the second year. The market for CEB technology is especially good in areas where soil of adequate quality is available and fired bricks are of poor quality.

Agency for Development Cooperation.

Investment: Rs. 1,00,000/- to 6,50,000/- depending upon scale of production and capacity of investment.

19

Micro Concrete Roofing Tiles (MCR)

The technology is aesthetic, durable and inexpensive sloping roof alternative. A variety of roof designs are possible for farm, verandahs, pavilions, SMEs, workshops and restaurants. MCR tiles allow total creative freedom to designers, architects and engineers to create a variety of roof forms.

MCR tiles are made from a carefully controlled mix of cement, sand, fine stone aggregate and water. The mix is vibrated at an optimum frequency for forty-five seconds on a precision engineered TARA TileMaker screeding table. It is then transferred to High Impact Polystyrene moulds that give MCR tiles their unique profile. After initial setting in an airtight environment for 24 hours, the tiles are cured in water for a period of 7 days.

Raw material: Cement, Sand, Fine Aggregate

Application: A variety of roof designs for farm and country houses, bungalows, verandahs and pavilions are possible with MCR

In India, MCR technology is promoted by TARA, Development Alternatives in association with SKAT of Switzerland and validated by the Building Materials and Technology Promotion Council, Ministry of Urban Development, Govt. of India.

MCR tiles offer many advantages over other sloping roof materials such as G.I. sheets, Mangalore tiles, wooden shingles, slate and asbestos. MCR tiles are highly cost effective, durable, lighter, easily installable, reduce heat gain and noise free during rains.

tiles. They have also been used on industrial sheds, workshops and restaurants. MCR tiles allow total creative freedom to designers, architects and engineers to create a variety of roof forms.

Standard: Indian Standard is under preparation.

Status: Around 200 entrepreneurs are producing MCR tiles.

Investment:

20

Ferrocement Roofing

Ferrocement roofing channels are prefabricated elements. The channels made with an optimised proportion of cement, sand and water, have a very high density, are impervious to penetration of water and provide high structural strength.

The mechanized system of production uses a vibrating table and profiled steel shell moulds. The production yard consists of a vibrating table positioned under a gantry system 6.5mts. in width. The gantry is fitted with a chain and a pulley system for ease of handling of shell moulds. A production team consisting of 2 masons, 6 semi-skilled workers and a supervisor can produce up to 5 channels of 4.6 mts. length each in 8 hours operation. The shell moulds are lifted with the cast channels in the

Development Alternatives.

Building Materials & Technology Promotion Council, Ministry of Housing & Urban Poverty Alleviation, Government of India (<http://www.bmtpc.org>)

Ferrocement technology is a highly profitable business for small scale building material producers or construction companies. A total investment of roughly Rs. 3,80,000/- for a mechanised production system assures a net profit of approximately Rs.1,50,000/- per annum. Ferrocement roofing channels, offer unmatched speed of construction and can be used for residences, primary schools, other community buildings,

green state. After 24 hours, the roofing channels are demoulded by using a specially designed mould lifting frame and demoulding tongs. The mechanised system does not require high skills but ensures high quality.

Raw material: Welded wire mesh, chicken mesh, cement, sand, fine aggregate, steel bars (8 to 12 mm dia) depending upon the span (upto 6.1 mtrs.)

Application: Ferrocement roofing technology offers a viable alternative to conventional flat roofing systems such as reinforced cement concrete, reinforced brick cement, sand stone, etc. in both rural and urban areas of the country.

Standard: BMTPC is taking up with BIS to prepare the Indian Standards.

Status: Commercialized; Product is being produced at several Building

porticos, verandahs, garages, industrial sheds, workshops, godowns, farm houses and semi-covered structures etc.

Centres.

Investment: Rs. 3,80,000/-

21

The Flyash brick making plant has been designed to manufacture flyash with FAL-G Technology. The heart of the plant "BRICK MAN" is an indigenously designed, a relatively low cost and high productivity machine.

Fly ash-lime-gypsum bricks and hollow blocks

The plant consists of the following equipment like Brick man, pan mixer, conveyer, pallet trucks and FAL-G mix: flyash lime and gypsum mix. In High Density Concrete Block Making Machine, wooden or steel pallets are fed and located by the chain conveyor, on high frequency vibrating table. Mould is filled manually which is over the pallet. The mix is pressed and vibrated on both sides simultaneously, resulting in voids free, high density blocks with excellent texture and finish.

Raw material:

Application:

Standard:

Status:

Investment:

INSWAREB, Visakhapatnam, Institute for Solid Waste Research & Ecological Balance, Bhanumathi International, Visakhapatnam - 530012

Cost effective, environment friendly and sustainable Energy Generation

22

Biogas plant (Agro-industry)

Treatment of solid and liquid wastes arising from agricultural

Degradation of non-edible oil seed cakes like castor, karanj, mahua

Tata Research Development and Design Centre 54B,

Little skill is required through short term training. Expected

<p>waste)</p>	<p>and agro-industries to produce methane-rich biogas for domestic fuel and organic manure for field crops. The technology is useful as it utilizes unutilized non-edible deoiled cakes, water weeds, solid and liquid wastes from vegetable oil industries and organic wastes from municipal market yards etc.</p>	<p>and sal containing toxic alkaloids in a methanogenic microbial consortia along with alkaloids in about 15 days HRT (hydraulic retention time) to produce methane-rich biogas with 65 - 70 per cent methane.</p> <p>Raw material: Wastes arising from agricultural and agro-industries.</p> <p>Application: Methane-rich biogas for domestic fuel and organic manure for field crops.</p> <p>Standard:</p> <p>Status: Pilot plants were installed at Indian Tobacco Company (ITC) at Sharanpur, U.P., Bombay Engineering Group (BEG) at Pune, Grama Nava Nirmana Samithi at Hyderabad.</p> <p>Investment:Rs 15 lakh</p>	<p>Hadapsar Industrial Estate Pune 411 013, Maharashtra Phone: 020-6871058 Fax:020-6810921 website: www.tcs.com</p>	<p>to be good for waste treatment, energy and manure generation It can also be implemented in vegetable oil mills (de-oiled cakes) and in cigarette factory waste (tobacco waste).</p>
<p>23</p> <p>Biogas plant- (Dairy effluent)</p>	<p>Anaerobic filter for treatment of dairy effluent and for Methane recovery at less cost.</p>	<p>The process produces biogas as a byproduct for use as engine or boiler fuel in the dairy. The unit consists of an anaerobic filter chamber and a gas storage tank. The dairy effluent while moving up</p>	<p>Sardar Patel Renewable Energy Research Institute, Post Box No. 2, Vallabh Vidyanagar, Gujarat 388120</p>	<p>A unit can treat 1 lakh litres of effluent/day at a cost of Rs. 12.50 lakh compared to Rs. 25 lakh for aerobic treatment. The payback period is 1.5 years. One lakh litres effluent / day</p>

in the reactor is acted upon by microbes present there. The BOD and COD levels are reduced by 90 per cent. The methane generated in the reactor is stored separately in a tank for use within the dairy plant for heating purposes / power application.

Raw material: Dairy effluent arising from poultry farm.

Application: Methane recovery at low cost as an alternative renewable energy source.

Standard:

Status:

Investment: Rs. 12.50 lakh

generates 5,24,900 kwh / year methane fuel of which only 4380 kwh / year are used for plant operation leaving a net energy surplus of 5,20,520 kwh / year for other uses. The plant produces only 5500 tpd sludge compared to 78,500 tpd in the case of aerobic treatment.

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**Biogas plant
(Fruit /
vegetable
waste)**

A bi-phasic digester to generate methane and manure from fruit and vegetable wastes. Fruit and vegetable wastes in large markets pose serious problems of disposal besides creating unsanitary conditions. The technology is, thus, ideal for disposal of waste with

The plant consists of an acid reactor, acid storage tank, methane generator and a gas storage unit. Unlike conventional biogas plants, the present unit uses minimum amount of water and requires little maintenance. A 2 tpd waste produces 60m³ of gas and 1 tpd

-do-

A 2 tpd waste treatment plant would cost about Rs. 6 lakh; pay back period is 3 year and good for fruit and vegetable market yards, fruit and vegetable processing plants etc.

additional benefit of biogas and manure.
organic manure production.

Raw material: Fruit and vegetable wastes.

Application: Generation of methane and manure.

Standard:

Status: Laboratory trials completed while field trials are in progress.

Investment: Rs. 6 lakh

25

**Gasifier system
(Biomass
bases)**

In this technology, woody biomasses like saw mill waste, cotton sticks, weeds like ipomea, lantana camera etc are converted into producer gas through partial combustion.

The system consists of a gasifier and a produced gas burner at the gas exit and operates on the chimney effect principle (updraft) without electricity. The producer gas burns with a clean flame and does not produce hazardous pollutants.

Raw material: Woody biomasses like saw mill waste, cotton sticks, weeds like ipomea, lantana camera etc.

Application: Production of gas

-do-

The technology helps to produce biogas with hazardous free pollutants and maximum capacity of the gasifier system is 80,000 kcal/h. The technology can meet the demand of the electricity demand of the interior rural areas.

through partial combustion.

Standard:

Status: Three plants of 80,000 kcal/h and 2 plants of 2 lakh kcal/h are commercialized in Gujrat.

Investment: Rs. 70,000/-

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Briquettes are an alternative energy source for household use as smokeless domestic fuel. The technology utilizes renewable energy source of biomass and agricultural and forestry wastes and meets the fuel demand of rural people.

The technology involves essentially two steps: (i) Preparation of charcoal from the locally and abundantly available pine cone and pine needles (or any other waste biomass) by a pyrolysis combustion process. (ii) Briquetting of charcoal in the presence of a binder and a little clay in a machine followed by solar drying. The end product is a smokeless domestic fuel.

Raw material: Locally available pine cone, pine needles, grass, leaves, saw dust, rice husk and any type of paper etc.

Application: Alternative energy source for household use as smokeless domestic fuel.

Himalayan Environmental Studies and Conservation Organisation (HESCO), Vigyanprasth, Gwar-Chauki, Gholtir, Rudraprayag 246 438, Uttaranchal.

Pyrolyser capacity: 400kg / operation,
15 operations/ month,

Briquettes production: 2478 kg/ month;

Price: Rs. 3/kg briquette.

No prior technical training is required and within the reach of rural women. Therefore, the technology offers high level of income generation particularly for the women group of rural areas.

**Briquette fuel
(from wastes)**

Standard:

Status: The extension centre of HESCO found wide acceptability of the technology through demonstration and training and if a stable market is provided the technology can serve as valuable for employment generation.

Investment: Rs. 28,600/-

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Urban solid waste consisting of leaf litter, trimmings of trees and hedges, and paper waste can be charred in this kiln.

The kiln consists of a steel barrel provided with a chimney. The barrel is filled with leaf litter. The leaves are ignited from the top and then the chimney is placed over the barrel. The leaves are allowed to burn for about 20 minutes, after which the chimney is lifted off and water is sprinkled on the burning leaves to extinguish the fire. Both the chimney and the barrel have been provided with handles for convenience of operation. After extinguishing the fire, the barrel is upturned on the ground and more water is sprinkled on the char to extinguish it completely. Each batch takes a load of about 6 kg leaves

Appropriate Rural
Technology Institute, Pune,
Maharashtra, india.

<http://www.arti-india.org>

In a day, one operator can complete 16 batches to obtain about 30 kg char. The char is mixed with starch paste (made from waste cereal flour) and extruded into briquettes. If one person in the family operates the kiln and another operates the hand operator extruder type briquetting machine, the family can make daily about 35 kg briquettes. The briquettes can be sold as domestic fuel for about Rs.10 per kg to give a daily income of Rs.350 to the family.

A handy kiln

**(charcoal from
urban leaf
litter)**

and it yields about 2 kg char per batch.

Raw material: Urban solid waste consisting of leaf litters, trimmings of trees and hedges, and paper waste etc.

Application: Conversion of urban leaf litter into charcoal.

Standard:

Status:

Investment: Rs. 3200 – 3230/-

28

It is a three pot chulha (stove), suitable for large households.

Astra Chulha

The fuel is fed into the combustion chamber through an enclosed bin, while primary and secondary combustion air enters the stove through openings above and below the grate. Hence by separating the fuel and air inlets the supply of combustion air can be controlled. Size of the air inlets, the distance between the grate and the first post and the clearance for hot gases under the second and third pots are crucial for efficient burning. The length, width and height of the

Centre for Application of Science and Technology in Rural Areas (ASTRA), Indian Institute of Science, Bangalore – 560 012, Karnataka.

stove are 190, 45 and 27 cm respectively.

Raw material:-

Application: Pot chulha (stove), suitable for large households.

Standard: The efficiency achieved is about 46%.

Status: Commercialized.

Investment:

29

Husk fired domestic stove

This is a one kind of stove made of mild steel sheet and angle iron. The inside of the furnace is lined with a mixture of fire clay and ground refractory bricks. In this stove natural draft for burning husk is created by a chimney.

The husk burns on an inclined grate and the ash is disposed off by a revolving grate. Cooking vessels are directly heated by the frames of combustion of husk. Water in the jacket of chimney is heated from flue gases. Stove size: 60x22x33 cm; Chimney size: 15x200 cm; Grate area: 570 cm²; Jacket height: 77 cm; Diameter: 255 cm; Capacity: 20 litres; Weight: 60 kg; Cooking capacity: 3.5 kg/h.

Raw material: Mild steel sheet and angle iron

Post Harvest Technology Centre, Indian Institute of Technology, Kharagpur – 721 302, West Bengal.

The technology not only eco-friendly but also cost effective as the operation cost is very minimum and around Rs. 0.50/- per hour. Therefore, easily affordable by the BPL families in rural areas.

Application: In this stove natural draft for burning husk is created by a chimney.

Standard:

Status:

Investment: Rs. 500/-

30

This is a smokeless mud stove.

The length, width and width of the stove are 70, 46 and 20 cm respectively. The diameter of first and second mouth is 20 and 18 cm respectively. Inside compartments are made in such a way that the ash is arrested in the bottom. To hasten the drying of the cook stove after construction the damper near the chimney is kept open for few days. The cost can be cut if a chimney of red clay pipe is provided.

CAPART, 58, Institutional Area, Pankha Road, Janak Puri, New Delhi – 110 058.

**Apoly
smokeless cook
stove**

Raw material: Clay, straw, dung and sand mixture.

Application: Smokeless mud stove.

Standard:

Status:**Investment:****31**

This is a power generation purely based on rice husks.

This technological model has many advantages like optimal utilization of wastage, rice husks and ash, reduction in carbon emissions, less dependency on fossil fuels, reduction of wastage in utilizing the power, stability of power, regional control over distribution and lower cost etc.

Recently, two Indians (one of them is a student from Virginia, US) from Husk Power System developed a viable business model to produce power by burning rice husks. For further information-

<http://ruralindia.blogspot.com/2008/05/financially-viable-rice-husk-power.html>

A single village setup can get gross income of about \$22,500 a year. Each plan can be staffed by three villagers: One to feed around 100 pounds of rice husks into the generator each hour, one to maintain the equipment, and one to collect payments from customers.

Husk power generators

Raw material: Mainly locally available rice husk.

Application: Power generation purely based on rice husks.

Standard:

Status: Currently, it has piloted in two villages of Bihar.

Investment:**32****Low Cost Green House**

The primary objective of greenhouse technology is optimization of all the inputs like nutrition, pesticide application, irrigation, light and

The basic structures are constructed using locally available bamboo or wood and covered with cladding material of UV stabilized low density polyethylene plastic sheets. The

Central Institute of Post Harvest Engineering and Technology, Ludhiana

Marketability of the technology has tremendous scope particularly for local artisans, however, they required to understand the design and

heat etc. The low cost plastic material allows only short wave length light to pass through it to improve crop production. The cultivation technology in which short wave length radiations fall a structure is constructed in either on crops or soil surface get different shapes suiting the reflected as long wave radiations local environmental conditions and remain within the green house. of the area. It allows the growing of crops independently of the outside climate and helpful for off-season vegetable / flower / nursery production.

Standard: -

Status: To be commercialized through farmers awareness programme.

Investment: The cost of constructing structure can be varied from Rs. 15-65 per m² depending upon the cost of the raw materials *i.e.* bamboo or wood in different locations.

construction of the technology for its wide adoption. The technology is required to be commercialized through farmers awareness programme.

Water Purification, Supply and Assessment Technologies

<p>33</p> <p>Arsenic removal from water</p>	<p>Process for domestic level removal of arsenic from water using an encapsulated composition.</p>	<p>The composition is a synergistic mixture of complexing co-precipitating and absorbing chemicals. Each capsule contains 0.6 g of the composition. A capsule is added to about 10 L water containing arsenic upto 0.3 ppm. Water is stirred well with a rod and</p>	<p>Central Mining Research Institute.</p>	<p>The cost of the product is only Rs. 0.10/- and therefore, vast market potentiality and wider diffusion possibilities in the arsenic prone areas including both rural and urban areas.</p>
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allowed to stand for 45 – 60 min.
 The treated water is filtered through cloth or a water filter candle. Arsenic content in the filtered water is below 0.005 ppm, which is within permissible limits (0.05 ppm).

Raw material: Capsules (available from CSIR).

Application: Arsenic-free safe drinking water.

Standard: -

Status: Know-how available for commercialization.

Investment: -

34

Chlorine tablets

Natural water is often contaminated with a number of bacteria, algae, protozoa, worms and other organisms and causes various diseases like cholera, amoebiosis, ziardiasis, gastro-enteritis, hepatitis etc. Boiling of water consumes huge fuel, and not convenient for mass scale

Raw materials are weighed and mixed in specified proportions. The mixed powder is fed to a tableting machine. The measured quantity of these tablets is filled in a plastic bag and sealed to make it air tight. These bags are then put in bottles. The bottles are then sealed, labeled and packed.

National Research Development Corporation (A Government of India Enterprise) 20-22, Zamroodhpur Community Center Kailash Colony Extension New Delhi 110 048. India
 Tel: 91-11-26419904,

Rural and semi-urban people drink water from ponds, rivers or open wells which are very susceptible to bacterial contamination. The source of water in urban areas is also often contaminated with municipal or industrial waste and effluents. Poor sanitation and sewage disposal in many

water treatment. Conventional methods of water treatment such as storage, coagulation, sedimentation and filtration etc. though reduce bacterial level to certain extent, are not sufficient to make the water safe.

Raw material: Stable bleaching powder, Sodium chloride, Calcium carbonate and Sodium carbonate etc.

Application: Convenient and cost effective technological product for disinfection of drinking water.

26417821, 26480767, 26432627; Fax: 011-26231877, 26460506, 26478010
 Website: www.nrdcindia.com

places also cause public health hazards. The demand for chlorine tablets for disinfection of water is, therefore, increasing day by day.

Standard:

Status: Well commercialized

Investment: Medium

Skill: Medium

35

'Portable Water Purifications unit' which uses specially developed chlorine tablets.

Water is poured in the main tank manually. Required quantities of chlorine tablets are added and the water is stirred. The stirred water is passed through chamber containing filter beds of charcoal, gravel and sand, Pure, disinfected and filtered water is finally obtained through taps fitted to the collecting chamber.

-do-

In rural areas, water is usually obtained from wells, ponds, lakes etc. Women at times have to fetch portable water from far off places. The conventional methods used to obtain portable water in the rural areas are complicated and expensive. The simple and inexpensive water purification methods can be of great value to the rural people for accessing of safe drinking

Water purification system

Raw material: Chlorine

tablet(50mg)

water.

Application: 'Portable Water Purifications unit' as low cost system to provide enough drinking water in rural areas.

Standard:

Status:

36

**Water filter
candles**

Raw water contains suspended impurities and pathogenic bacteria, which are responsible for water borne diseases, like cholera, typhoid, jaundice etc. Water filter candles is an efficient process as well as inexpensive for domestic use.

The process for the production of filter candles consists for grinding the non-plastic materials (china clay, insulated brick powder, quartz, feldspar etc.), mixing with organic materials and casting the candles in moulds of desired shapes.

Raw material: crusher; ball mill, sieves and coal-fired down drought / electric / oil fired furnace.

Application: Various types of domestic containers for getting bacteria free potable water.

Standard:

-do-

An investment of around Rs. 5.80 lakhs is needed to establish a unit to produce 100 candles per day. Cost of production of a candle is Rs. 30 and the unit provides employment opportunity for 10-12 persons.

Status: Commercialized

Investment: Rs. 5.80 lakhs

37

Water filtration bucket to remove turbidity, soluble iron, manganese, fluoride impurities and bacterial contamination.

The device comprises of a 60-150 L cap. PVC bucket fitted with a tap and a cylindrical sand filter housed in a nylon bag and perforated 150 mm PVC pipe. Raw water is filled in the bucket and treated with filter alum, bleaching powder, sodium aluminate and lime. It is allowed to settle for an hour. Clean potable water is withdrawn from the outlet tap. When the filter gets clogged, nylon bag containing sand is taken out of casing, cleaned and replaced.

National Engineering Institute.

Environmental Research

**Multipurpose
Domestic Water
Filter**

Raw material: Raw water, sand, alum, bleaching powder, lime, sodium aluminate.

Application: Domestic level potable water in the villages.

Standard: -

Status: -

Investment: -

**Test kit for
Microbiological
quality of
Drinking Water**

It is a simple device kit to test the potability of drinking water. This test does not need any laboratory facility, inexpensive, reliable and convenient method of testing in field conditions.

The process is based on the detection of H₂S producing organism in drinking water which are present alongwith coliforms. The process is the preparation of 20x concentrated media by mixing some chemicals in a definite proportion. Dry and sterile media is provided in the screw capped bottle which is ready for use. The water to be tested is filled upto the upper level of the bottle and bottle is gently shaken for 5 minutes and kept at room temperature for 18 hrs. and the changes indicate the results.

Raw material: Peptone, Dipotassium-hydrogenphosphate, Ferric amm. Citrate, Sod.thiosulphate, Teepol and water.

Application: Testing potability of drinking water.

Standard:

Status:

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Website: www.nrdcindia.com

The conventional method of testing the micro biological quality of water needs the service of a qualified microbiologist, laboratory facilities and takes 72 hrs. to know the result. Further getting this test done in the laboratory is expensive. But this test kit is cheap and has a great market potential.

Investment:

Skill:

39

Design system for storage of rainwater at domestic/community level.

For a domestic scheme, rainwater run off is gathered from the rooftops, courtyards and small catchment platforms and stored hygienically in FC tanks after passing through filters. In community level schemes, larger catchment areas are used for collecting run off water in underground tanks, fenced reservoirs or directing the water to lakes.

Structural Engineering
Research Centre, Ghaziabad.

**Rain Water
Harvesting**

Raw material: Treated roof/platforms, inflow system, by pass system, ferrocement water tanks of 200x2000 L cap.

Application: Useful in areas where water supply schemes are expensive (e.g. hills), ground water is saline (e.g. coastal areas, islands); to supplement existing provisions.

Standard:-

Status: Widely implemented in NE region.

Investment: Rs. 2 lakh for 2000 L cap tank.

40

Process to augment under-ground water resource and check soil erosion.

The concept of 'hill to valley' is adopted to arrest rainwater at selected points in the catchment area. In the hilly terrain, continuous as well as discontinuous trenches are made while in the valley, continuous trenches, boulder check dams or ponds are constructed on secondary/tertiary drains. These water storage structures recharge the ground water and raise the water table level. This also checks soil erosion. Micro watersheds can be planned in semi-arid zones. It takes 3 yr for marked impact.

Regional Research Laboratory, Bhopal

Watershed Development

Raw material:-

Application: Sustainable water supply in dug wells/hand pumps; augment drinking water supply & irrigation potential, check soil erosion, reclamation of wastelands.

Standard: -

Status: Commercialised.

Investment: Rs. 4,000/ha in a typical case.

41

Process for recharge of ground water aquifers/hand pumps/dug wells/tube wells through rainwater.

The groundwater structures are recharged by allowing rainwater to percolate down the aquifers at leisure pace thereby raising the water table. For this activity, suitable weathered/fractured zones are identified for recharge after field investigations w.r.t. geology, topography and location. Micro catchment artificial recharge plan is developed. In a typical case of hard rock, small stop/check dams are constructed in pervious geological formations, which allow percolation of rainwater. The impact can be noted after 1 yr.

-do-

**Artificial
Recharge of
Ground Water**

Raw material: Local loose boulders, clay, sand, etc.

Application: Supply of sustainable drinking water to villages having acute water scarcity, particularly

during summer months.

Standard: -

Status: Commercialised.

Investment: Rs. 0.60 lakh in a typical case

42	Pedal operated water pumping device.	One unskilled person of 60 kg wt can irrigate about 2000 m ² of land in 8 hr. It does not require any electric power. A pump of length 875 mm, width 490 mm, height 575 mm weights about 35 kg and can be easily transported by 2 persons.	Central Engineering Institute.	Mechanical Research	Water discharge 7,000 L/hr, operational cost Rs. 100/day of 8 hr shift.
Pedal Pump		Raw material: Mild steel and rubber tube of truck.	Application: It is used to lift water from the ponds, streams, and shallow wells up to a head of 2 m for irrigation purpose.		
		Standard:-			
		Status: Commercialised.			
		Investment: Rs. 2,000.			

Environment and Sanitation

43	Disinfection of Equipment for disinfection of	The system can be designed for	Central	Scientific
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Sewage Water

sewage and drinking water using ultraviolet radiation.

varying capacities ranging from 100 L/hr to 1 lakh L/hr. The process is physical rather than chemical and avoids chlorination and ozonation. It is very safe and leaves no residue.

Instruments Organisation.

Raw material: Secondary treated sewage water / drinking water.

Application: Simple and economical system of on site disposal of waste water in rural areas.

Standard: -

Status: In operation at pilot plant scale

Investment: Depends upon capacity and use.

44**Soak Pits**

The use of water for domestic purposes is increasing which gives rise to problems of collection, conveyance, and disposal of wastewater in villages. The wastewater flows and spreads on the roads and in open places & accumulates in

`SILT catcher' acts as a trap for these pits. The washing platform of 0.9 m x 0.9m size made of bricks laid on edges in cement mortar (1:6) and is connected to the soakage pit through the silt catches.

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Employment intensive for unskilled and semi-skilled labourers in rural areas.

ditches and low lying areas causing nuisance and health hazards due to breeding of mosquitoes, which can transmit dreadful diseases like malaria and filaria. Soak pits is a simple and economical system for providing on site disposal to control this.

Raw material: silt catcher
Application: Simple and economical system of on site disposal of waste water in rural areas.

Standard: -
Status: -

Investment: Less

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26478010
Website: www.nrdcindia.com

45

Silt-ash trap chamber system using brick in-situ construction at site

It is a simple, efficient and economical disposal system consisting of a silt-ash trap chamber and a borehole for underground disposal of wastewater within courtyard of the house. The silt ash trap chamber is divided into two compartments each having a triangular duct. The ducts are provided with entry and exist at the bottom and are inter-connected at the top. The second compartment is filled with brick ballast. The system can be constructed in situ by using bricks. It can also be precast by

Central Building Research Institute.

**Disposal of
Domestic
Waste Water**

using ferrocement.

Raw material: Locally available materials such as burnt brick, cement, sand, coarse aggregate, reinforcing steel

Application: Suitable for disposal of waste water from kitchen and bathroom in rural houses.

Standard: -

Status: The technology has been extensively used in villages.

Investment: Rs. 750

46

**Dual System
Cistern**

Design system for conversion of conventional bell/siphon type flushing cisterns in the residential buildings into dual flushing cisterns.

The operation is easy and smooth, partial discharge of water after urination, full discharge after defecation.

Raw material: Flushing cisterns

Application: Water conservation for sanitation purpose in buildings.

Standard: -

Status: Field trials conducted on

-do-

The cost of conversion of a conventional flushing cistern into dual flushing cistern is about Rs. 50. If installed during construction stage, no additional cost is involved. The water conservation is 50% per flush (5 L instead of 10 L).

large scale; incorporated in IS: 774-1984.

Investment: -

47

Design and construction of low cost latrines in the areas where sewerage system is not available.

It is a simple, economical and efficient system for disposal of night soil without pollution. The system consists of two leaching pits, WC seat (slope 30o) and water trap. The leaching pits are connected with the PRAI type seat through an inspection chamber using clay/cement concrete/plastic pipes or brick channels. The leaching pits are used alternatively with a gap of 4-5 yr.

-do-

Low cost latrine

Raw material: PARI type WC seat and water-seal traps made of china clay, FRP mosaic or cement concrete, bricks, cement, sand, stone aggregate and reinforcing steel.

Application: Low cost sanitation in the areas where sewerage system or septic tank is not feasible due to shortage of water or financial

limitations.

Standard: -

Status: Extensively used in India and other developing countries.

Investment: Rs. 3,500

48

An efficient and economic drainage system of plumbing

All the sanitary appliances in a group discharge soil and waste into a single stack. In this system, the main stack itself serves as the vent. It has simple design procedure, which relates hydraulic discharge in the stack to the pipe diameter for permissible suction inside stack.

-do-

It is efficient and economical as compared to conventional two-pipe system. Wet areas are planned around duct and require less space.

**Single Stack
Drainage
System**

Raw material: Building drainage pipes/fittings

Application: Sanitation plumbing in high as well as low rise buildings.

Standard: -

Status: Technology incorporated in IS: 5329-1969 and National Building Code of India-1970;

adopted by construction agencies.

Investment: -

49

Fabrication of septic tanks using ferrocement.

The circular or rectangular septic tanks constructed with brick masonry are not fully watertight and also occupy a large space. Use of FC as construction material in septic tanks is advantageous, as it is impervious to water. Precast components of vertical circular septic tanks are fabricated and assembled. The septic tanks are made of two precast units: sludge digestion chamber and de-sludging pit. Rural artisans can easily acquire the technology for its manufacturing

Structural
Research Centre

Engineering

30% less cost as compared to brick masonry.

FC Septic Tank

Raw material: Cement, sand aggregate, chicken wire mesh, plastic sheets.

Application: Sanitation purpose in rural areas, hills and regions where good quality bricks are not available.

Standard: -

Status: Commercialised

Investment: -

50

Process for manufacture of red clay based sanitarywares.

Low cost sanitary wares are produced from inexpensive raw materials like local red clay in conjunction with ball clay, quartz, feldspar, dolomite etc. The raw materials are ground, mixed and de-watered in usual manner and articles cast by slip making process or hand molded.

Central Glass & Ceramic Research Institute.

**Red Clay
Sanitary ware**

Raw material: Red clay, feldspar, ball clay, dolomite, quartz etc

Application: Rural sanitation.

Standard: -

Status: Commercialised.

Investment: Rs. 10 lakh.

Food Processing

51

**Pan-Supari
Nectar**

Pan supari nectar is a beverage which can be made in villages.

It is the extract of essential constitutements of a pan vic. betel leaves, kattha areca- nut etc. The astringent and intoxicating effects commonly experienced, while

Central Food and Water Defluoridation (Nalgonda Technological Research Institute, Mysore 570 013 Technique), Removing excess Fluoride from Water, Terracotta Water Filtration Disc (Terafil), Rapid Bacterological Aqua

chewing pan are mellowed here. The betel leaves, arecanut (powdered), katha, their essential ingredients are thoroughly extracted. The cooled mass is strained through muslin cloth. Sugar syrup and small quantities of calcium, citric acid, and flavouring materials are mixed with it. Betel decoction and sugar syrup, as prepared above, are mixed in appropriate proportions to get the final product.

Tester

Raw material: -

Application: As beverage

Standard: -

Status: -

Investment: Rs. 2000/-

<p>52</p> <p>Bottling of Coconut Water</p>	<p>Coconut water in a bottled form provides a good source of value addition. This can also be exported. All equipment and machines required for the process are available indigenously.</p>	<p>About 50% of the annual production of 6000 million coconuts is dried into Copra and used for oil extraction. Coconut water from ripe coconuts is filtered and processed for upgrading and preservation. It is then filled into cleaned and sterilized</p>	<p>Regional Laboratory P.O. Trivandrum-695 019</p>	<p>Research Industrial Estate, Pappanamcome,</p>	<p>For a unit with capacity of 200 litres /day, by which 1000 bottles of 200ml capacity each can be filled.</p>
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bottles and sealed using a standard crown corking machine. Carbonation if desired is possible using a carbonating machine.

Raw material: Coconut, locally available equipment and machines etc.

Application: Coconut water in a bottled form.

Standard: -

Status: -

Investment: Rs. 4.0 lakhs.

53

A ready-to-serve-drink beverage.

The process enables sugarcane juice to be converted into a ready-to-serve-drink beverage. The pH of sugarcane juice is manipulated by the addition of edible organic acids, followed by incorporation of certain natural antioxidants. The resultant product is pasteurised and preserved in hermetically sealed glass or food-grade plastic containers.

Raw material: Sugarcane juice,

Ushodaya Enterprises Ltd.,
Eenadu Complex,
Somajiguda, Hyderabad 500
082, Andhra Pradesh.
Phone:040-3323717
Fax:040-3393640

Sugarcane juice sold by the bazaar vending units is already very popular. The beverage resulting from the improved process is likely to command much higher popularity because of its superior quality and hygienic standard. The individual's more than fifty years of experience and interaction with a cross-section of professionals have shown that there is a reasonably good

**Preservation of
Sugarcane
Juice**

		<p>edible organic acids, natural antioxidants Sugarcane peelers and juice extractors, blending tanks, heating stoves/furnace, bottle washing, filling and closing equipment.</p> <p>Application: Improved process for preserving sugarcane juice over extended periods without the need for refrigeration.</p> <p>Standard: Applied for patent.</p> <p>Status: Not commercialized.</p> <p>Investment: Rs. 1.50 lakh</p>		<p>market for the product By and large, production units are best located where sugarcane is commercially available</p> <p>Capacity: 1,00,000 x 200 ml packs/year;</p>
<p>54</p> <p>Liquid Fruits</p>	<p>Liquid fruits as an alternative to synthetic beverages.</p>	<p>The process involves pulping of fruit, warming to a desired temperature, cooling and enzyme and the ready-to-eat products. The treated juice is stored at low temperature for 2-3 days, filtered, bottled and pasteurized.</p> <p>Raw material: Pulpy fruits like banana, guava, apple, mango, jackfruit, cashewapple, sapota, etc.</p> <p>Application: Transformation of</p>	<p>Central Food and Technological Institute Research</p>	<p>The ready-to serve beverages are both refreshing and thirst quenching. The liquid fruits can be used as a natural alternative to synthetic beverages. They can be suitably diluted, blended with other juices and carbonated as soft drinks. There is a good domestic and export market. Since the fast food sector is expanding rapidly the demand, particularly for</p>

		<p>pulpy fruits into liquid by using pectic enzymes.</p> <p>Standard: -</p> <p>Status: -</p> <p>Investment: -</p>		<p>tomato ketchup and sauces, is also increasing. Tomato processing can be advantageous to raise the rural economy and to generate employment. The units can be set up in cooperative sector. Better market strategies can be worked out to sell the products in urban centres.</p>
55	<p>Fruit-based carbonated drinks. It is ready for adoption by any entrepreneur.</p>	<p>The technology involves preparation of fruit juice, fruit syrup base and their carbonation and processing.</p> <p>Raw material: Lime, grape, aonla, jamun etc.</p> <p>Application: Ready-to-serve fruit based beverages as natural health drinks and excellent refresher with no artificial colour, flavour or essence.</p> <p>Standard:</p> <p>Status: During 1999 and 2000, the product was sold in Pusa Campus at flower shows and in Krishi Mela; there was considerable interest</p>	<p>Post Harvest Technology Unit of the Division of Fruits and Horticultural Technology, IARI, New Delhi 110 012</p>	<p>Vast scope not only in urban but also in rural areas, where fruits are in plenty particularly among those who want natural products for good health. or in the consuming centres Pusa Fruit Drinks, an IARI's internal production-cum-demonstration unit is producing and selling these beverages on commercial lines. Efforts are being made to transfer the technology</p>

Fruit Beverages

among people.

Investment: Rs. 11 lakh excluding land and building for production of one-lakh bottles (200 ml) per annum.

56

Shelf life extenders for fruits and vegetable without refrigeration

These simple technologies are based upon the method for isolation of natural active ingredient and its conversion to various fruit specific formulations which are cost-effective and substantially increase the shelf life of fruits and vegetables without refrigeration.

The coating active is a natural oligomeric terpenoidal component obtained from natural lac resin after extensive treatment involving solvent reflux, filtration, precipitation, charcoalization, decolourization and fractionation. Some of the fruits and vegetables that can be coated are Apples, plumbs, oranges, sweet lime, grapes, pears and lemons, tomatoes, brinjal, capsicum etc.

Raw material: Hexane, Methanol and Lac etc.

Application: Enhancement of shelf life of fruit & vegetables without refrigeration, alteration in natural colour, texture and maintenance of natural gloss of fruits and vegetables without waxing etc.

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Website: www.nrdcindia.com

Large volumes of fruits and vegetables are wasted every year due to weak transportation and storage infrastructure, low tech harvestings, low usage in food processing and relatively low exports. The technology is valuable as it requires locally available resources, cost-effective, energy efficient (without refrigerator), less skill and labour intensive. Therefore, can be promoted as non-farm activity establishing small and medium scale enterprises for employment generation.

			<p>Standard: To be commercialized.</p> <p>Status: Demonstration in different states of the Indian Union.</p> <p>Investment: Medium</p> <p>Skill: Less / labour intensive</p>	
57	Extraction of essence from curry leaves as a food supplement / flavor.	It is a liquid filled in a sealed vial of 10 ml. The average capacity of the extraction unit is around 300 vials / day.	<p>Raw material: Fresh curry leaves in large quantities either from own orchards or from market, distillation set, working bench and electrical connections etc.</p> <p>Application: Essence from curry leaves as an aroma supplement in food items.</p> <p>Standard: -</p> <p>Status: -</p> <p>Investment: Medium (Rs. 1 lakh)</p>	<p>Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad - 500 059, Andhra Pradesh</p> <p>Preliminary introduction of this product at Kisan Fairs showed good acceptability. It helps to add considerable value to the curry leaf growing farmers and fetches more income than selling fresh leaves and it advantageous to do in curry leaf growing areas.. It also helps to process the fresh leaf when there is excess production and glut in the market and favours women also.</p>
58	Malted Beverages with Vegetable Proteins	An alternate beverage product of milk enriched with vegetable proteins utilizing indigenously available vegetables as natural	<p>The process mainly consists of using either protein isolate or protein rich flours of edible quality as the base. These are mixed in a suitable</p>	<p>National Research Corporation (A Government of India Enterprise) 20-22,</p> <p>In India supply of milk is limited and hence beverage food based items like (malted milk powder or food beverages)</p>

	resources.	proportion with fine flours of malted millets, milk and sugar, and flavour base, etc.	Zamroodhpur Center Extension 048. India	Community Kailash Colony New Delhi 110	mainly on vegetable protein sources which are indigenously available in great demand in the market.
		Standard: -			
		Status: -		Tel: 91-11-26419904, 26417821, 26432627; Fax: 011-26231877, 26460506, 26478010	
		Investment: Less			
		Skill: Less		Website: www.nrdcindia.com	
59	Utilization of honey for the preparation of ready-to-serve beverage based on honey and honey-ginger products.	This is a process formulation involving mixing of honey with hot sugar syrup, racking, filtering using special filtering aids addition of colour and preservative, filling in bottles, cooking and pasteurization etc. Honey-ginger beverage is made by the addition of ginger extract at appropriate time, during the manufacture.	Central Technological Institute, Mysore	Food and Research	It is advantageous to undertake production of honey based RTS beverages in existing fruit processing / bottling units where facilities are ready available, thus reducing the cost of product- ion considerably. In areas where surplus honey is available at reasonable rates, especially in rural areas which are within the reach of marketing centres, it is possible to start a unit of desired capacity.
	Honey Based Beverages	Raw material: Honey, ginger, plant, machineries, land etc.			
		Standard: -			

Status: -

Investment: Medium

Skill: Medium

60

Floral Honey

Bee keeping is practised coupled with floriculture. In hills, box hive is a failure and the traditional wall hive for beekeeping is practised. Himalayan Environmental Studies and Conservation Organisation (HESCO) has been involved intimately in the efforts to promote the traditional avocation of bee keeping coupled with floriculture in the hills. It has modified the traditional bee hive with little cost which enhances the production of honey many times.

Raw material: For the construction of wall hive: bricks, cement, sand, wood, jeybolt, iron rods and concrete Gloves, bee veil (to protect face), hive frame, vessels to feed the bees

Application: The merits of bee keeping coupled with floriculture are: floriculture is an income generating activity and also offers rich source of nectar and pollen; provides bee pasturage during dearth period; prevents migration of the bees after honey extraction; honey production increases

Standard:

Status: Commercialised as well as in production.

Investment: Cost of wall hive, bee colony, feed material and implements Rs. 3200 Training by

Himalayan Environmental Studies and Conservation Organisation (HESCO), Vigyanprasth, Gwar-Chauki, P.O: Gholtir, District Rudraprayag 246 438, Uttaranchal

Vigyanprasth in Rudraprayag and Women Technology Park in Dehradun impart training on the above mentioned technology Himalayan honey is specific because the flowers are unique in the mountain region. "Unifloral honey" has its own selective demand because of its characteristic medicinal value. The technology has been accepted by the villagers. A few women groups in Dehradun and Chamoli have constructed their wall hive and started the work At present local markets and local shops are the means of marketing. "Unifloral honey" and higher altitude honey can add new dimensions in honey marketing We don't have any terms and conditions for technology transfer but our

		HESCO.		target groups are rural people
61	Coffee brew concentrate is a new dimension of coffee preparation in liquid form taking in view the convenience and changing pattern of consumption of the consumers.	The process consists of roasting selected raw seeds and grinding to coarse powder which can then be wetted and extracted in jacketted percolater using hot water. The coffee brew is then stored in glass bottles under carbon dioxide atmosphere.	Ministry of Food Processing Industries Panchsheel Bhawan, August Kranti Marg New Delhi -110049 website: mofpi.nic.in	The quality of the concentrated coffee brew is superior than the filtered coffee and therefore can get good market potential with a wider opportunity for being used in hotels, and other big catering establishments etc.
	Coffee Concentrate	Raw material: coffee roaster, grinder, extractor, bottling unit and carbonator. Standard: NA Status: NA Investment: Medium Skill: Medium		
62	Flavouring of tea helps in developing indigenous expertise in the latest line of non-conventional tea beverages and also augments value addition to our medium and fair quality teas.	The raw materials required are BOP fanning grade orthodox tea, flavour blends and other ingredients which are locally available. The flavouring system consists of inclined drums, provided with feeding hopper, flavour application system, heating facility and	Central Food Technological and Research Institute, Mysore	Flavoured teas are in use in USA, UK and other Western countries. There is a good potential for flavoured tea for export as well as domestic market.
	Flavoured Tea			

arrangement for self discharging. Suitable flavour blends like lemon, jasmine, ginger, bargamot and mint have been standardised.

Raw material: Flavour blends, Flavour application system, Drying and Packaging.

Application: Flavouring of tea helps in developing indigenous expertise in the latest line of non-conventional tea beverages and also augments value addition to our medium and fair quality teas.

Standard:

Status:

Investment: The know-how is available at CFTRI on payment of Rs.1, 00,000/- by way of crossed DD drawn in favour of Director, CFTRI, Mysore; Cost on plant and machinery: Rs.18 lakh.

63

Fish Pickle

The pickle developed has an emulsion consistency & contains fried fish in an aqueous medium of acid, salt,

The process consists of frying of fish, equilibration (preconditioning) with acid & salt, blending with spice

-do-

spices, condiments & sugar. A mix, bottling with covering oil.

covering oil is used in the bottled product. The pickles have a tested shelf-life of over a year at room temperature. No external preservative is used.

Raw material: In expensive varieties like cat-fish & shark fillets may be used. Other raw materials used are chilli powder, turmeric powder, salt, mustard, tamarind, sugar, acetic acid, ginger, garlic, clove, cinnamon, cumin & vegetable oil.

Application: An emulsion consistency & contains fried fish in an aqueous medium of acid, salt, spices, condiments & sugar.

Standard:

Status:

Investment: Cost on plant & machinery: Rs.1.25 lakh. The process is released through CFTRI on payment of lumpsum premium of Rs.4, 000/- by way of DD drawn in favour of Director, CFTRI, Mysore.

64

Fish maws

Fish maw is the washed and dried air or swim, bladder of certain fresh water and marine

The air bladder is cut open, internal membranes are removed, washed well free of blood and beaten

Central Institute of Fisheries Technology, Willingdon Island, Matsyapuri PO.,

Good market acceptability mainly in Malaysia, Hongkong, Singapore, Thailand, Japan,

fishes. In India, maws are against a piece of wood till well mostly obtained from air flattened. The flattened pieces are bladders of marine fishes like dried in the sun till bone hard. Daria, Jew Fish, Cat fish and Central Institute of Fisheries Eels. Good quality fish maws Technology (CIFT) has standardised are white, thin, transparent and the method for export quality fish tough, when freshly prepared. maws.

Kochi - 682 029, Kerala.

New Zealand and United Kingdom.

Raw material: Marine and fresh water fish, wet airbladder, water etc.

Application: Clarification of wines.

Standard: NA

Status: Commercialized.

Investment: Medium (Rs. 5 lakh).

65

**Products from
Chicken**

A process for poultry dressing & manufacture of ready-to-cook products like chicken meat sausage, canned chicken & chicken steaks.

The merits of the standardized process are low cost gadgets for various unit operations involved in poultry dressing. All the equipments can be fabricated indigenously; ready-to-cook product; product quality & hygiene. Economics: Capacity: 250 birds/day, Cost on plant and machinery: Rs.4 lakhs. The process can be released

through NRDC, New Delhi on payment of lumpsum premium of Rs.10,000/- on non-eclisive basis.

Raw material:

Application:

Standard:

Status:

Investment:

Agro-farm Machinery

66

**Bullock-Drawn
Automatic
Sugarcane
Planter**

Sugarcane planting is a labour-intensive operation. On an average, it requires 17 man-days and 2 pairs of bullocks to plant one hectare with the conventional 'desi' plough. A bullock-drawn planter has been designed and developed which carries out all the operations automatically.

The frame-work are provided a drive system, a seed box, a metering system,a fertilizer, a seed box, an insecticide container, a furrow opening shovel, & a seed chute. The drive system consists of gears and chain-sprockets and separate levers for engaging and disengaging the drive. Arrangements are made for lowering and lifting the depth of planting. On an average, 100 m row is covered within 2 minutes. All the planting operations are accomplished in a single pass.

Indian Institute of Sugarcane Research, Rai Braielly Road Post Office: Dilkusha, Lucknow

The automatic bullock drawn sugarcane planter greatly facilitates planting of sugarcane. On an average, an output of 1.25-1.5 ha.day is achieved with reduced labour requirement and at about 1/5th the cost that the conventional system would entail.

Raw material:

Application: A bullock-drawn planter

Standard:

Status:

Investment: Rs. 500

67

Swaraj cultivator is a multi-purpose implement for plowing, cultivating, scarifying & pasture renovating.

Heavy-duty spring loaded tines mounted on a sturdy steel frame provide excellent trash clearance with deeper penetration. Constant tine vibrations shatter the sub-soil to let roots & moisture penetrate deep into it. It has optional groundwheels to control tilling depth when used with tractors without depth-control hydraulics.

Punjab Tractors Ltd., S.A.S. Nagar, (Near Chandigarh) India High-field output saves fuel.

Cultivator

Raw material:

Application: Multi-purpose implement for plowing, cultivating, scarifying & pasture renovating

Standard:

Status:

Investment:

68

Disc Plough

A rugged and sturdy Swaraj disc plough, a versatile implement suited for tough soil conditions.

Heat treated steel discs are mounted on double heavy duty precision taper roller bearings. A choice of 3 working angles for the disc & lateral shift on cross shaft enables optimum setting under extreme conditions. Individual disc scrapers are adjustable to meet any soil condition & ensure proper trash coverage. Working depth is controlled by tractor hydraulics.

Punjab Tractors Ltd., S.A.S. Nagar, (Near Chandigarh) India

Raw material:

Application: A versatile implement suited for tough soil conditions.

		Standard:				
		Status:				
		Investment:				
69	Five Row Manual Rice Transplanter	A simple manually operated rice planting machine to save labour and reduce drudgery involved in conventional method of transplantation. It enables transplantation of rice sapling in a systematic manner and increases productivity.	Raw material: SS sheets, Timber etc. Application: Agriculture Status: NA Standard: NA Investment: Low Skill: Less	National Development Corporation (A Government of India Enterprise) Zamroodhpur Community Center Kailash Colony Extension New Delhi 110 048. India	Research Corporation 20-22, 110 048. India	Improved implements and tools play vital role in increasing agricultural production. The product helps to reduce drudgery of manual operation and cut down operation time in the fields.
70	Groundnut Shelling	A simple groundnut shelling sieve to reduce drudgery and improve efficiency.	The sieve is made from an iron sheet of 2 ft x 3ft in size. Holes not more than 1/2 inch diameter are made over the sheet in rows except for a strip of 2 inches wide around the edges. The holes are made by hammering from one side, using the sharp end of a bicycle-pedal spindle. Then the sheet is turned	Council for Advancement of People's Action and Rural Technology, Guru Nanak Foundation Building, New Mehrauli Road, New Delhi	Manual shelling of groundnuts is laborious and inefficient. A simple groundnut shelling sieve can be fabricated to reduce the drudgery and improve efficiency.	

over and smaller holes are made using a 3 inch nail in the space between the holes already made. Now the iron sheet is fitted into a wooden frame so that the sheet forms the bottom of the sieve. A handful of groundnuts is charged in the sieve and rubbed back and forth using a flat-bottomed stone or wood. The protruding sharp edges strip the shells off the groundnuts and the kernels fall through the larger holes in to a container placed below the sieve

Raw material: Materials and skills are available in villages.

Application: Simple groundnut shelling sieve to reduce drudgery and improve efficiency.

Standard:

Status:

Investment: Nominal

The traditional method of drilling seeds behind a bullock operated plough requires considerable human skill and experience to achieve even seed distribution over the entire field. The hand-actuated seed metering device can be effectively used to overcome the problems of the traditional method. Even an inexperienced person can use it for drilling seeds with uniform distribution.

**Hand-Actuated
Seed Meter**

The device consists of a square section mild steel pipe, fitted with a spring loaded lever and a gate to regulate the flow of grain. The seed inlet end is made round in section to facilitate fitting of a flexible PVC tube. The cloth bag filled with seeds and carried on the operator's back is connected with the device by means of a PVC tube. The device is held in one hand while the seed bag is carried on the back. Seed metering is done by depressing the lever approx. once every second, while the person walks along with the plough at a normal speed. The seed rate can be adjusted by changing the stroke length of the lever. A screw is provided to adjust the lever stroke. The greater the stroke length the faster would be the seed distribution rate. The device has been tested with wheat. It can be fabricated by village artisans.

Raw material:

Division of Agricultural
Engineering Indian
Agricultural Research
Institute, New Delhi

		<p>Application:</p> <p>Standard:</p> <p>Status:</p> <p>Investment: The device with cloth bag costs about Rs 35 when made as a single unit locally.</p>	
72	<p>Hand-Maize Sheller</p> <p>Used for hand-shelling of grains from maize. It has high output of maize grain compared to removal of grains by palms. It is hygienic & convenient method of maize-shelling & has anticipated life for 3 years.</p>	<p>Raw material:</p> <p>Application: Hand-shelling of grains from maize.</p> <p>Standard:</p> <p>Status:</p> <p>Investment: Rs12 per piece.</p>	<p>Centre for Development of Rural Technology Institute of Engineering & Rural Technology, 26, Chatham Lines, Allahabad</p>
73	<p>Improved sickle</p> <p>An improved cutting tool designed with a crescent shaped blade, short cranked handle (for semicircular cutting motion) and straight blade (fastened almost a right angle to the handle which is long and sometimes slightly covered at the end to give a better pull).</p>	<p>Raw material: Iron, timber etc.</p> <p>Application: Cutting tools</p> <p>Standard: NA</p> <p>Status: NA</p> <p>Investment: Less</p> <p>Skill: Less</p>	<p>National Research Development Corporation (A Government of India Enterprise) 20-22, Zamroodhpur Community Center Kailash Colony Extension New Delhi 110 048. India</p> <p>Tel: 91-11-26419904, 26417821, 26480767, 26432627; Fax: 011-</p> <p>Sickles are generally made of rather soft blades which have to be frequently hammered to produce a right angle before sharpening with a whetstone. The blades are some times made to have serrated cutting edge to increase their efficiency. But they are difficult to sharpen. The above drawbacks can be overcome in this improved version of the</p>

			26231877, 26460506, 26478010 Website: www.nrdcindia.com	sickle, thereby have good market potential in the rural areas particularly in agricultural field during cultivation of crops etc.
74	It is human-operated and reciprocating-typed water-lifting pump. Low-Lift Pump	This pump has been developed by modification of the hand pump. Raw material: Application: For minor irrigation and easy operation. Standard: It can irrigate about 1/6 acre land in 12 hours. Status: Investment: Rs 2000	M.P.Polytechnic Gorakhpur, P.O. Lachchipur, Gorakhpur (U.P.)	
75	The electronic rodent killer is a special, totally automatic machine which attracts rats, kills instantly and disposes of immediately. Electronic Rodent Killer	Raw material: Application: Rodent killer Standard: Status: Investment:	Central Electronics Engineering Institute, Pilani	It is the first of its kind developed anywhere and the interest shown by the farmers in this machine is unbelievable. It works with 12 V battery. If the device is used on a large scale, several lakh tonnes of foodgrains can be saved annually.
76	Power Paddy	Raw material: Steel angles, rod	Regional	Research Capacity of the machine is

<p>Thresher</p>	<p>and sheet, bearings, V belt etc.</p>	<p>Application: Useful for threshing of paddy grains at low labour cost and high output. The power paddy thresher is popular in orissa at present. Capacity of the machine is 2500 kg/hr compared to 300 kg/hr paddy by manual method.</p> <p>Standard:</p> <p>Status: Commercialised by Dept. of Agric. Eng., Govt. of Orissa. 4000 machines have already been sold in less than 3 yr.</p> <p>Investment: Rs. 5 lakh/ Rs 6,000 per machine.</p>	<p>Laboratory, Bhubaneswar - 751013</p>	<p>around 300 / Yr with cost of production around Rs 6,000 per machine.</p>
<p>77</p> <p>Power Paddy Thresher-cum-Winnower</p>	<p>Machine for threshing as well as winnowing of grains after harvesting of paddy.</p>	<p>Raw material: Mild steels sheet, angle and rod, etc.</p> <p>Application: The machine is used for threshing as well as winnowing of grains after harvest of the paddy. Both the operations are carried out simultaneously by a 1 HP motor. Threshing capacity is 300 kg/hr and winnowing capacity is 1500 kg/hr.</p>	<p>Regional Laboratory, Bhubaneswar- 751 013</p>	<p>Research The operation is very simple. The machine separates the grains from the straw as the paddy bundles are fed to the machine. 200 units are already sold within a year.</p>

	<p>labor during cutting cocoons manually.</p>	<p>locally available materials.</p> <p>Raw material: Mild steel (angles, rods, etc), bearings, V-belts, pulleys, bolts and nuts, electric motor (1/2 HP), etc.</p> <p>Application: Sericulture industry for the production of silkworm eggs.</p> <p>Standard: Patented</p> <p>Status: Commercialized</p> <p>Investment: Medium</p> <p>Skill: Less</p>	<p>Mysore</p> <p>National Research Development Corporation (A Government of India Enterprise) 20-22, Zamroodhpur Community Center Kailash Colony Extension New Delhi 110 048. India</p> <p>Tel: 91-11-26419904, 26417821, 26480767, 26432627; Fax: 011-26231877, 26460506, 26478010</p> <p>Website: www.nrdcindia.com</p>	<p>emergence is a common practice for the production of silkworm eggs. Currently, sex determination is carried out at pupal stage cutting cocoons by blade manually on an average 400 cocoons per hour per person. This machine can cut 6000-8000 cocoons per hour or about 50,000 cocoons per day (in a shift of 8 hours). Therefore, the product has strong market potential for the sericulture industry particularly for the grainages and licensed seed producers where large scale egg productions are being conducted.</p>
<p>80</p> <p>Cocoon Deflossing Machine</p>	<p>Cocoon deflossing machine is a machine to remove unreelable layer of silk over the cocoons called floss to minimize drudgery and cost of labor etc efficiently.</p>	<p>The machine is simple in construction and can be fabricated/manufactured using locally available materials. The raw cocoons are automatically fed through a slanting hopper to a roller covered with rough paper (specially fabricated to remove floss). As the roller moves, the floss adheres to</p>	<p>Central Sericultural Research and Training Institute, Mysore</p> <p>National Research Development Corporation (A Government of India Enterprise) 20-22,</p>	<p>Presently, the cocoons are manually deflossed and on an average 20 kg of cocoons per hour can be deflossed by a person (in a shift of 8 hours). This machine can defloss 50-100 kg cocoons per hour (depending on the capacity of the machine used) or about</p>

		<p>the rough surface of the roller and the deflossed cocoons moves away due to the smoothness and is collected in another hopper kept below. The floss collected on the rough surface is manually removed periodically.</p> <p>Raw material: Fabrication/Mechanical workshop with facilities for turning, sheet metal cutting, welding, spray painting, etc. Application: Sericulture industry Standard: Patented</p> <p>Status: Commercialized</p> <p>Investment: Medium</p> <p>Skill: Less</p>	<p>Zamroodhpur Community Center Kailash Colony Extension New Delhi 110 048. India</p> <p>Tel: 91-11-26419904, 26417821, 26480767, 26432627; Fax: 011-26231877, 26460506, 26478010</p> <p>Website: www.nrdcindia.com</p>	<p>400-800 kg cocoons per day (in a shift of 8 hours). Therefore, the product has strong market potential for the sericulture industry.</p>
<p>81</p> <p>Mulberry leaf chopping machine</p>	<p>This is a mulberry leaf chopping machine for continuous operation to minimize the drudgery, save time and labor cost.</p>	<p>The machine is simple in construction; depending on the requirement adjustments can be made in the machine to cut the leaves to any size; can be fabricated/manufactured using locally available material.</p> <p>Raw material: like mild steel (angles, etc), bearings, V-belts,</p>	<p>Central Sericultural Research and Training Institute, Mysore</p> <p>National Research Development Corporation (A Government of India Enterprise) 20-22,</p>	<p>The young age silkworms (first and second instar larvae) need to be fed with mulberry leaves cut in to small pieces. The size of the leaf pieces depends upon the stage of growth of the silkworms. Generally, the chopped leaf size varies from 3 mm to 35 mm. Presently, the mulberry leaves are chopped</p>

<p>pulleys, steel blades, bolts and nuts, electric motor (1/2 HP), etc.</p> <p>Application: Sericulture industry</p> <p>Standard: Patented</p> <p>Status: Commercialized</p> <p>Investment: Medium</p> <p>Skill: Less</p>	<p>Zamroodhpur Community Center Kailash Colony Extension New Delhi 110 048. India</p> <p>Tel: 91-11-26419904, 26417821, 26480767, 26432627; Fax: 011-26231877, 26460506, 26478010</p> <p>Website: www.nrdcindia.com</p>	<p>manually which is a time consuming process and this can be practiced only for small scale rearing of silkworms. For large scale rearing of silkworms and for chawki (young age silkworms) rearing centers large quantity of leaves have to be chopped for feeding the silkworms. The leaf chopping machine can operate continuously saving time, labour minimizing drudgery, therefore, has strong market potential in the sericulture industry.</p>
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Rural Industrialization

<p>82</p> <p>Alternative Washing Machine</p>	<p>This is a low cost washing machine specially designed for the poor households of the rural areas. The perspective users of the product design are low cost washing machine manufacturers.</p>	<p>It is powered by electricity & the household bucket is an integral part of the machine. A prototype was developed to simulate the washing machine action using the oscillatory fan motor.</p> <p>Raw material: Electricity, household bucket, oscillatory fan etc.</p> <p>Application: washing machine</p>	<p>Foundation for Innovation and Technology Transfer (FITT)</p> <p>Indian Institute of Technology, Hauz Khas, New Delhi-110016, INDIA</p> <p>Tel : 91-011-26597167, 26857762, 26581013, 26597153</p> <p>Fax : 91-011-26851169</p>	<p>Washing is a daily activity in most households, however, penetration of washing machine is only 2% (compared to penetration of detergents which is almost 100%) in rural areas due to higher investment. An alternative washing machine priced below Rs.1500/- can have good market potential in the rural areas.</p>
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manufacturers.

E-mail

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drkdpn@gmail.com

Status: Not commercialized

Standard: NA

Investment: Low

Skill: Less

83

Papad making machine

Papads form a popular food adjunct in Indian dietary. It is a thin wafer-like product, circular in shape, rolled from dough made out of pulse flour, with or without added spices. Though traditionally confined to the household, papad making in recent years has developed into cottage scale and small-scale industry

The papad press is manually operated, simple and easy to operate machine that can make around 500 papads/h. The papad dough is kneaded into semi-tough dough, made into balls of 5-6 and pressed into 1-mm thickness using papad press. The pressed circular shaped papad is dried to 14-15% moisture level.

Raw material: Urd dal, any pulse flour, salt, farinaceous material, spice mix, water etc.

Application: Fabrication of papad press and papad as food adjunct suitable home/cottage scale enterprise
Status: Well commercialized
Standard: NA

Investment: Low

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Website: www.nrdcindia.com

Papad production is in unorganized sector. About 95% of papad produced in the country are made in the household or cottage scale. Papads are exported to more than 40 countries from India. The major importing countries are UK USA, UAE, Singapore, Oman, Nigeria, Malaysia, Kuwait, Canada, Bahrain and Australia.

Skill: Less

84

Production of papad using Papad Press.

Papad' is a thin wafer like product, circular in shape, rolled from dough made out of pulse flour. The papad dough is made from pulse flour (preferably urd dal), salt, carbonates, farinaceous material and water. The contents are kneaded into semi tough dough. The dough is made into balls of 5-6 g and pressed into 1 mm thickness using papad press. The pressed circular shaped papad is dried to 14-15% moisture level.

Central Food Technological Research Institute.

Papad Press

Raw material: Blackgram dal, pulse flour, salt, farinaceous material, spice mix.

Application: As food adjunct.

Standard:-

Status: Commercialised.

Investment: Rs. 0.05 lakh.

85

Rope making machine

Rope is made from different types of fibre like jute, flax, hemp, coir, pineapple etc. and utilized as a variety of uses in

The machine can be easily operated by sitting on a stool by simple pedaling as in a sewing machine and maintenance is easy. The

National Research Development Corporation (A Government of India Enterprise) 20-22,

A person can produce 5-10 Kg/h using this machine as against 500-700 gm by the manual methods in vogue. It

	<p>every day life. The rope is usually made in villages manually in a laborious manner, involving considerable amount of drudgery. To eliminate the drudgery, provide employment opportunities and enhance the earning capacity of the rural population, a simple rope making machine using easily available sewing machine parts and bicycle components has been designed.</p>	<p>capacity of the machine is 100 kg/day in a single shift per day. The actual minimum land requirement is 30 m².</p> <p>Raw material: Natural fibre</p> <p>Application: Khadi and Village Industries</p> <p>Status: Yet to be commercialized</p> <p>Standard: NA</p> <p>Investment: Low (Rs. 2000/-only)</p> <p>Skill: Less</p>	<p>Zamroodhpur Community Center Kailash Colony Extension New Delhi 110 048. India</p> <p>Tel: 91-11-26419904, 26417821, 26480767, 26432627; Fax: 011-26231877, 26460506, 26478010</p> <p>Website: www.nrdcindia.com</p>	<p>can provide self employment to women and children in villages, who can earn Rs. 15-20 per day by making ropes, sutlis etc. from easily available and inexpensive fibrous materials.</p>
<p>86</p> <p>Simple Pulse Dehusking Machine</p>	<p>Pulses are mainly consumed in the form of dehusked split dal. Conversion of pulse to dal is probably the third largest food processing industry. The dal processing is done as a small scale rural or cottage operation from ancient times. Recently it has been taken up as a large-scale commercial operation. The newly developed low cost pulse-dehusking machine is hand as well as power (0.5 HP) operated.</p>	<p>The technology consists of soaking the raw material in water and drying in sun. The dried material is fed into the machine to get the dehusked dal. Cleaning and grading are done manfully. The capacity of the plant is 1500 tons/yr.</p> <p>Raw material: Pulse (tur, blackguard green gram Bengal gram)</p> <p>Application: Edible dal, broken husk as by products; cottage scale enterprise.</p>	<p>National Research Development Corporation (A Government of India Enterprise) 20-22, Zamroodhpur Community Center Kailash Colony Extension New Delhi 110 048. India</p> <p>Tel: 91-11-26419904, 26417821, 26480767, 26432627; Fax: 011-26231877, 26460506, 26478010</p> <p>Website: www.nrdcindia.com</p>	<p>Dals are essential items of food and are in great demand. The dal obtained by simple dehusking method compares well with that obtained from modern dal mills.</p>

			Status: NA	
			Standard: NA	
			Investment: Low	
			Skill: Less	
87	This is a new generation weaving machine having improved features to improve the efficiency of the weaver and quality of the woven fabrics.	The loom consists of fly-shell, special take-up mechanism, negative let off, backrest and improved frame. All these parts are so carefully designed that it conforms to the traditional workmanship to produce more and better quality fabrics.	National Development Enterprise) Zamroodhpur Community Center Kailash Colony Extension New Delhi 110 048. India	Research Corporation 20-22, 20-22, Zamroodhpur Community Center Kailash Colony Extension New Delhi 110 048. India
	Tara Loom		Raw material: Wooden frams, SS sheets and Rods.	Tel: 91-11-26419904, 26417821, 26480767, 26432627; Fax: 011-26231877, 26460506, 26478010 Website: www.nrdcindia.com
			Application: Versatile tool for the village wavers; home/cottage scale enterprise.	
			Status: NA	
			Standard: NA	
			Investment: Low	
			Skill: Less	
88	Bullock Cart	A bullock cart with improved The yoke and harness design in the	Foundation for Innovation	It is comparatively cheaper and

with Improved Bearing and Wheel Designs	wheel bearing and wheel design.	improved cart are such that animals can carry load without strain. This increases the pull of the animals to some extent. Bearings are of journal type, easy to make with locally available materials in the villages, reduce wastage of draft power and enhance load carrying capacity of cart.	and Technology Transfer (FITT) Indian Institute of Technology, Delhi Hauz Khas, New Delhi-110016, INDIA Tel : 91-011-26597167, 26857762, 26581013, 26597153 Fax : 91-011-26851169 E-mail : drkdpn@gmail.com	carries more load than any other conventional bullock cart. It can be run by 1 or 2 bullocks by simple adjustment in the fixing arrangement of carry beams. The bearings are self lubricated type and are dust proof. It is based on flitched beam concept and simple techniques which the local artisans can themselves apply for fabrication therefore, the product can facilitate good market opportunity for the rural people and farmers to enhance income level.	
Application: Rural people, farmers Standard: NA					
Status: NA					
Investment: Less					
Skill: Less					
89	Leaf cup / Plate making machine	A pedal operated machine to make leaf cup / plate utilizing natural resources like leaves of banana, beutia, bauhimia, arecaunut sheet, pseudostem of banana etc. by improving dimensional stability, appearance, shape finishing and hygienic quality of the product.	The salient feature of this machine is that in one single pedal operation, folding, trimming, pressing into shape and drying are done; about 250-300 leaf cups or 100 acres sheeth cups per hour can be made by skilled operator and a helper. The leaf cup being subjected to heating to 150°C for about 10 seconds gets sterilized.	Ministry of Food Processing Industries Director (Administration) Ministry of Food Processing Industries Panchsheel Bhawan, August Kranti Marg New Delhi -110049 website: mofpi.nic.in	A number of units can be installed in rural areas to generate employment and entrepreneurship among village craftsmen.

Application: Village craftsmen

Standard: NA

Status: NA

Investment: Less

Skill: Less

90

A simple minigrain mill to refine coarse grains and wheat suitable for cottage scale operation especially in rural areas.

In this mill, the simple chakki machine has been modified suitably to have arrangements for water-mixing, sieving and aspiration. In one single step the refined oil and flour can be obtained from wheat/maize/ jower/ bajra/ ragi and other grains. The refined product obtained by this mill can be used for the preparation of chapati, upmav, idli, dosas, kesaribhath etc. Husk/bran and brokens are obtained as by-products.

Standard: NA

Status: NA

Investment: Medium

Skill: Less

Ministry of Food Processing Industries
Director (Administration)
Ministry of Food Processing Industries
Panchsheel Bhawan, August Kranti Marg
New Delhi -110049
website: mofpi.nic.in

Coarse grains and millets such as Maize, Jower, Bajra, Ragi, etc., are generally used by the economically weaker sections of the society especially in rural areas. It is known that these cereals and millets contain the non-edible fibrous husk/bran to the extent of 8-15%. By imparting minimal refining by mini grain mill, these grains can be made not only tasty but also easily digestable without reducing much of the nutritional factors.

Mini Grain Mill

91

Design for mini rice mill.

Mini rice mill has the features of a modern rice mill. It provides 5% higher yield of head rice in addition to saving valuable rice bran. The mini rice mill with capacity 300-500 kg paddy per hr meets the needs of the villages. This mill consists of a paddy cleaner, sheller, separator and a polisher. In this unit shelling and polishing are kept separate.

Central Food Technology
Research Institute.

300-500 kg paddy/hr

Mini Rice Mill

Raw Material: -

Application: Milling of rice.

Byproducts: husk, bran and broken rice.

Standard:-

Status: In production at a large number of units.

Investment: Rs. 1.25 lakh

Skill: Low

Others

92

***Azotobacter* Biofertilizer**

An economic biofertilizer as supplementary to nitrogen fertilizers (application of *Azotobacter* biofertilizer @ 20

The Process requires mass culture of microorganisms in shake-flask or fermentor. The culture is then mixed with the carrier material

Central Sericultural Research and Training Institute, Mysore. www.csrtimys.res.in

This indirectly reduces the costs involved in the silkworm rearing aspects as well as the soil health is improved by

kg per hectare per year assures a substantial saving of nitrogen fertilizer by about 50 %) for mulberry cultivation.

(preferably lignite or coal) under hygienic conditions and packed immediately in polythene bags. The batch number and expiry date are immediately affixed on each bag. Normally, packets are available in 250 g, 500 g, 1.0 kg and 5.0 kg denominations. Normally, the shelf life of the biofertilizer is six months from date of manufacture.

increased microbial activity.

Raw material: Locally available plant, machinery and raw materials for manufacture.

Application: As supplemental to nitrogen fertilizers for mulberry cultivation.

Standard: As per the BIS norms

Status: Commercialized

Investment: Less

Skill: Medium

93	Digested Organic Supplement Technology	Digested organic supplement is the end product obtained by converting various organic wastes such as agriculture	This is a conversion process to control and maintain the quality of product and maximise the retention of nutrients. The various organic
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wastes (residues like coir pith, mushroom waste, poultry droppings, animal dung, etc.) into a useable fertilizer by a modified aerobic-cum-anaerobic process of composting.

wastes received from the farms or other sources are segregated and allowed to decompose under controlled conditions and environment by creating an optimal C:N ratio for decomposition. On completion of composting, the material is transported to the plant in closed bags.

Raw material:

Application:

Standard:

Status:

Investment:

94

Jigat

An agro-based biopolymer and economically competitive substitute for Jigat (trade name of powdered barks of *Machilus macrantha* and *Litsea chinensis* used as binding material in agarbati manufacture).

Raw material: Agrobiopolymers, synthetic biopolymers

Application: As a substitute of Jigat to minimize threats for the survival of *Machilus macrantha* and *Litsea chinensis* and industrial production.

Standard: NA

Forest Research Institute

National Research Development Corporation (A Government of India Enterprise) 20-22, Zamroodhpur Community Center Kailash Colony

The technology for the manufacture of the substitute is simple and can easily be translated to industrial production to minimize threat for the survival of *Machilus macrantha* / *Litsea Chinensis* and pressure on natural forests shall be overcome.

		<p>Status: NA</p> <p>Investment: Less</p> <p>Skill: Less</p>	<p>Extension New Delhi 110 048. India</p> <p>Tel: 91-11-26419904, 26417821, 26480767, 26432627; Fax: 011- 26231877, 26460506, 26478010</p> <p>Website: www.nrdcindia.com</p>	
<p>95</p> <p>Resham Keet Aushad</p>	<p>Resham Keet Oushadh (RKO) is an important chemical used in the Sericulture Industry as silkworm rearing bed disinfectant to inactive pathogenic microbes responsible for Muscardine and Grasserie diseases in silkworm. It is also effective for prevention of nuclear polyhedrosis.</p>	<p>RKO is economical and applied after each moult after bed cleaning and before feeding the leaves. its usage increases the cocoon yield on an average of 7.00 kg per 100 disease free layings (dfls). It is easy to use and has no adverse effect on silkworm health, human beings and domestic animals. RKO is produced from locally available chemicals. The chemicals are dried, powdered to 200 mesh size, sieved mixed and packed in an air-tight polythene bags immediately. The quality of the product is maintained by using specified quality of chemicals and ensuring the right quantity of mix. The shelf life of RKO is six months</p>	<p>Central Sericultural Research and Training Institute, Mysore. www.csrtimys.res.in</p>	<p>There is an estimated annual demand of 500-700 tonnes and the actual production is only 50-70 tonnes per annum. The product has a large demand since it is used in all the Sericultural areas. The present market price is Rs.20.00 per kg and the production cost is Rs.11.00 per kg. The quantity of RKO required for treating 100 dfl's is 3.25 kg.</p>

from the date of manufacture.

Application: Sericulture Industry

Standard: NA

Status: Commercialized

Investment: Less

Skill: Less

96

Vijetha

Vijetha is a new chemical introduced in the Sericulture Industry as silkworm rearing bed disinfectant to kill pathogenic microbes responsible for Grasserie, Muscardine, Pebrine and other infectious diseases of silkworm.

Vijetha is a chemical applied after each moult after bed cleaning and before feeding the leaves. This chemical is economical, easy to use and has no adverse effect on silkworm health, human being and domestic animals. It is produced from indigenously available chemicals. The preparation consists of acid treating an inert material, drying it, powdering to 200 mesh size, mixing with other chemicals, sieving and immediately packing in air-tight polythene bags. The quality is maintained by using specified quality of chemicals and ensuring the right quantity of mix. The shelf-life of Vijetha is six months from

Central Sericultural Research and Training Institute, Mysore. www.csrtimys.res.in

Vijetha has a wider range of action against silkworm diseases and hence its demand is estimated at 700 tonnes per annum in the sericulture regions of our country. The cost of production is around Rs.14.00 per kg and the market price can be around Rs.22.00 per kg. The quantity of Vijetha required for treating 100 dfl's is 2 kg.

date of manufacture.

Application: Sericulture Industry

Standard: NA

Status: Commercialized

Investment: Less

Skill: Less

97

Uzitrap

A unique formulation in the form of tablet which adopts the strategy of first attracting the adult tachinid fly (popularly known as Uzi fly, *Exorista bombycis*, an endo-parasitoid of the delicate silkworm, which causes 15-20% crop loss annually) and then killing it.

The process of manufacture involves simple mixing and tableting steps. All the ingredients and equipment/machinery required are available indigenously. The manufacturing process of this tablet does not cause pollution as the product is free from any toxic chemicals. However, the CSRTI has suggested that this product be kept beyond the reach of children and domestic animals. The product is in the form of yellow round tablet weighing approximately 2.5 g.

Application: Sericulture Industry

Standard: NA

Central Sericultural Research and Training Institute, Mysore. www.csrtimys.res.in

This eco-friendly way of managing the tachinid fly has been evaluated in the states of Karnataka, Andhra Pradesh and Tamil Nadu. On an average, the product has shown to trap about 40 flies per crop (rearing) and helps in increasing the cocoon yield by 3 to 4 kg per 100 disease free layings (dfis). One packet containing 12 tablets is required for rearing 100 dfis. The present market price of one packet is Rs.10.00 (Rupees ten only). There is an estimated demand of about 10 lakh packets, which has been on the rise each year. The

		<p>Status: Commercialized</p> <p>Investment: Less</p> <p>Skill: Less</p>	<p>product has good market potential in the states of Karnataka, Andhra Pradesh and Tamil Nadu, as there are no such products available in India.</p>	
98	<p>Degumming of Silk with Fungal Protease</p> <p>An alternative method for removal of protein from silk particularly removal of sericin from mulberry type of silk yarn with a fungal protease enzyme. The traditional method for removal of such protein from the silk involves extraction of silk with water followed by boiling off in soap with alkali, acid and enzyme. Such known method suffer from one or the other disadvantages like high energy and time consumption as well as quantity of water used has a greater influence on the quality of silk leading to loss in lustre of silk etc.</p>	<p>Raw material: Protease fungal enzyme etc.</p> <p>Application: Sericulture Industry/Silk Reeling Industry</p> <p>Standard: Patent application no. 2493/DEL/98</p> <p>Status: NA</p> <p>Investment: Less</p> <p>Skill: Less</p>	<p>Foundation for Innovation and Technology Transfer (FITT)</p> <p>Indian Institute of Technology, Delhi Hauz Khas, New Delhi-110016, INDIA</p> <p>Tel : 91-011-26597167, 26857762, 26581013, 26597153</p> <p>Fax : 91-011-26851169</p> <p>E-mail : drkdpn@gmail.com</p>	<p>The process has strong market potential due to several advantages like saving of time (three hours to complete the process) and energy (at reduced temperature of 37°C to carry out the process). In addition, the process does not employ any soap, acid and alkali and therefore, quality of the raw silk remains superior.</p>
99	<p>Cooking Process for Silk Cocoons</p> <p>This is a cooking process for silk cocoons especially tasar cocoons. The cocoons so obtained are deflossed to</p>	<p>The process for cooking tasar cocoons comprise a container having amine solution to dip cocoon fully, treating at a temperature of</p>	<p>Foundation for Innovation and Technology Transfer (FITT)</p> <p>Indian Institute of</p>	<p>Easy and energy efficient process to produce good quality silk yarn over the conventional method and therefore have</p>

remove the upper flossy layer from the cocoons and to find out the rear end of the cocoon filament to facilitate the reeling operation. The bulk of the silk filament obtained by this process was of better quality than those by conventional methods.

70 to 90°C for a period of 30 to 120 minutes, washing with water and squeezing them gently to remove excess water.

Raw material: Tasar cocoon, cocoon cooking machine, amine solution, water, oven etc.

Technology, Delhi good market potential.
Hauz Khas, New Delhi-110016, INDIA
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Application: Sericulture Industry/Silk Reeling Industry

Standard: Patent application no. 1628/DEL/95

Status: NA

Investment: Less

Skill: Less

100

Composting and Vermicomposting

This is technology to propagate and use earthworms for faster degradation of partially composted wastes to manage environment pollution free and hygienic.

The technology involves management of the right species of worms under conditions optimal for the vermicomposting process in a time period of 4 weeks or less.

Raw material: Right species of earthworms, kitchen wastes and pit etc.

Foundation for Innovation and Technology Transfer (FITT)
Indian Institute of Technology, Delhi
Hauz Khas, New Delhi-110016, INDIA
Tel : 91-011-26597167, 26857762, 26581013,

The biodecomposable wastes such as kitchen wastes, if not properly managed can create insanitary environment conducive to insect breeding and spreading of diseases. Conventional composting is an age old technology and there are limitations due to the

		<p>Application: Can be operated at household, community and township level.</p> <p>Standard: NA</p> <p>Status: NA</p> <p>Investment: Less</p> <p>Skill: Less</p>	<p>26597153</p> <p>Fax : 91-011-26851169</p> <p>E-mail : drkdpn@gmail.com</p>	<p>longer time periods required for completion of the process. This new technology can be valuable for urban and rural households and habitats.</p>
<p>101</p> <p>Jalshakti</p>	<p>Jalshakti is a granular organic superabsorbent product especially designed to improve plant-water relationship. When mixed with soil, and or any synthetic growing medium, Jalshakti increases both its water retention capacity & aeration thus improving the soil quality; it also helps reducing the frequency of irrigation. By proper application, jalshakti can help protect plants against water stress and by improving aeration of the growing media it can aid in producing plants with healthier systems. Jalshakti is an off-white free-</p>	<p>The product is quite hygroscopic but retains its free flowing character even at 50% water absorption. The major use of jalshakti is expected to be in agriculture as soil amendment when mixed with soil, and as seed-coating at the time of plant-ing. It can also be used as a soil reclaiming agent in arid lands.</p> <p>Raw material:</p> <p>Application: Improvement of plant-water relationship</p> <p>Standard:</p>	<p>National Chemical Laboratory, Pune, India</p>	<p>COST The application jalshakti has given an increase in yield of 17-42% over the untreated plots, corresponding to an additional income of about Rs 1000-4000 per hectare after taking into account the cost of application.</p>

	<p>flowing powder. Its water absorption capacity decreases in the presence of salts and is independent of temperature in the range 20-70 °C.</p>	<p>Status:</p> <p>Investment:</p>		
<p>102</p> <p>Cold Sterilization of Cow and Buffalo Milk in India</p>	<p>A microfiltration system for removal of contaminating bacteria and spores.</p>	<p>The process of micro filtration to separate particle size as low as 0.05 um-10um is useful to increase substantially shelf life of the processed milk. Membranes used for this purpose are inorganic membranes whose working life is more than 10 years.</p> <p>Application: Dairy Industry</p> <p>Standard: NA</p> <p>Status: NA</p> <p>Investment: Less</p> <p>Skill: Less</p>	<p>Foundation for Innovation and Technology Transfer (FITT)</p> <p>Indian Institute of Technology, Delhi</p> <p>Hauz Khas, New Delhi- 110016, INDIA</p> <p>Tel : 91-011-26597167, 26857762, 26581013, 26597153</p> <p>Fax : 91-011-26851169</p> <p>E-mail : drkdpn@gmail.com</p>	<p>Microfiltration technique is quite superior to the conventional thermal techniques. Spores removal is better using micro filtration than any other techniques. Therefore, the method economically attractive and strong market potential in the dairy industry.</p>
<p>103</p> <p>Low cost preservation of eggs</p>	<p>A low cost technique to preserve the shell eggs by treatment with egg washing powder and egg coating oil. The egg washing powder has a combined detergent and</p>	<p>Washing powder is prepared by grounding washing chemicals to uniform size and homogeneously mixing the required proportion. Antifungal and bacteriostatic agents are dissolved in a solvent and</p>	<p>National Research Development Corporation (A Government of India Enterprise)</p> <p>20-22, Zamroodhpur Community Center Kailash Colony</p>	<p>Demand of poultry egg in the country is very large. The treated shell eggs by this low cost technique can be kept preserved for 10 day @ 38°C, 4 weeks @ 25-30°C, 12 weeks @</p>

sanitizing action. It helps in lowering bacterial load and increasing the keeping quality.	stirred well continuously while warming. The solvent mixture is added to hot mineral oil, heated stirred cooled and stored.	Extension New Delhi 110 048. India Tel: 91-11-26419904, 26417821, 26432627; Fax: 011-26231877, 26478010 Website: www.nrdcindia.com	13°C and 24 weeks @ 7°C. Therefore can easily be adopted in poultry farms and wholesale trade for supply of cleaned eggs with superior quality. The technique of low cost preservation of eggs can also be promoted as cottage / tiny scale enterprises in the rural areas for employment generations.
	Raw material: Sanitizing and detergents agents, mineral oil, antifungal and bacteriostatic agents, solvent.		
	Application: Poultry farm / Cottage / tiny scale enterprise		
	Standard: NA		
	Status: NA		
	Investment: Less		
	Skill: Less		

Information Technology-Link on Rural India

Literacy and Education

104 E-learning

An e-learning system, K-yan has been developed by IL&FS ETS in collaboration with IIT, Bombay to meet the urgent need for a low-cost new media product, specially designed for group learning in schools and other learning communities. The prime objective is to provide enhanced learning solutions to different segments of society particularly for the rural people at affordable prices through the use of technology. The key players in the market are Alcatel, TI, Motorola etc. For further details go to <http://www.k-yan.com>.

105 Tarahaat

A network of franchised rural communities and business centres **to empower people to achieve their aspirations by using Information and Communication Technology (ICT). The services of the tarahaat network can broadly be classified as to promote literacy programme by** developing educational courses delivered through ICT for the people in rural and peri-urban areas, agri-advisory voice based question and answer services to rural communities, access to information and livelihood opportunities comparable to those available in urban India, entrepreneurship opportunities to youth, women and self-help groups of the rural and marginalized communities through expanding network of TARAKendras, TARAhaat's rural business-cum-community centers with a purpose to integrate them with the mainstream economy and sale of products and services designed for the rural markets etc. For further details go to <http://www.tarahaat.com>

Services

106 Teleconnectivity

Idea Cellular Ltd, India's leading cellular operator, headquartered in Pune has launched the Shared Access (Voice & Data) program for Rural India The services help in connecting the un-connected and extends the accessibility of communication whilst creating a new revenue stream for low income rural entrepreneurs who own the mobile phone. For further details go to http://www.afags.com/news/company_news/Marketing/8788.html

107 High-tech Banking

Banks in India have been puzzling to provide services to Rural villages in India. Recently, Financial Information Network & Operations Ltd has taken some innovative initiatives to solve this tricky puzzle using bio-metric smartcard systems in a way to help MicroFinance organizations, Banks, Insurance companies. For further details go to <http://www.fino.co.in>

Health and Telemedicine

108 Sanjeevani

An integrated telemedicine application launched specifically to cater to the rural Indians, who live in an environment characterized by paucity of qualified doctors, almost non-availability of specialists and specialist care, several patients being serviced by unqualified practitioners, late discovery of ailment and delay in institution of appropriate treatment due also to greater time required for transport to urban/ district healthcare facilities and provision of healthcare by inexperienced primary healthcare service providers. For details go to <http://www.jpgmonline.com/text.asp?2005/51/4/308/19245> (Sood SP, Bhatia JS. Development of telemedicine technology in India: "Sanjeevani"-An integrated telemedicine application. J Postgrad Med 2005;51:308-11)

109 HealthSAT project(Indian Space Research Organization)

A project initiated by ISRO that provides infrastructure for rural areas as well as the communication bandwidth via its dedicated HealthSAT satellite. A telemedicine system in a small health centre consists of a personal computer with customized medical software connected to a few medical diagnostic instruments, such as an ECG or X-ray machine or an X-ray scanner for scanning X-ray photos. Through this computer, digitized versions of patients' medical images and diagnostic details (such as X-ray images and blood test reports) are dispatched to specialist doctors through the satellite-based communication link. The information, in turn, is received at the specialist centre where experienced doctors examine the reports, diagnose, interact with the patients (along with local doctors), and suggest appropriate treatment through video-conferencing. For details go to <http://medicine.plosjournals.org/perlserv/?request=get-document&doi=10.1371/journal.pmed.0030082>

110 Apollo Telemedicine Networking Foundation

One of the first groups to venture into the telemedicine arena in India, this group hopes to provide a successful working model of Telemedicine, which self propagates throughout India and into the developing world. For details go to <http://www.telemedicineindia.com>

111 Quality Healthcare

Thousands of residents of rural villages in India are receiving quality eye care thanks to a collaborative effort between an Indian hospital network and the researchers at the University of California, Berkeley, and at Intel Corporation who have developed a new technology for low-cost rural connectivity. For details go to (http://www.berkeley.edu/news/media/releases/2006/06/06_telemedicine.shtml).

(Compiled and prepared by D. Gangopadhyay)