



Punjab State Biotech Corporation

AGRI-FOOD TECHNOLOGY INVENTORY OF PUNJAB

2021

**Developed Under
Secondary Agriculture Entrepreneurial Network in
Punjab (SAEN)**

Supported by



Biotechnology Industry Research Assistance Council

INDEX

S.No.	Particulars	Institute	Page No.
1	Background		3
2.	Technologies under Fruits & Vegetables processing sector		
i.	Premix for ready to fry potato snacks	PAU, Ludhiana	6
ii.	Technology for processing and packaging of shelf stable Onion Products		8
iii.	Frozen potato and frozen vegetable technology		10
iv.	Technology for Ready to Serve Shelf Stable Bottled Sugarcane Juice		12
v.	Farm level Fruit & Vegetable Washing Machine		14
vi.	Brewed Fruit Vinegar Technology		16
vii.	Low alcoholic naturally carbonated (LANC) beverage production technology from fruits, vegetables and its blends (amla, plum, guava, grapes, carrot)		18
viii.	Automatic Custard Apple Pulper	CIPHET, Ludhiana	21
ix.	CIPHET-Pomegranate Aril Extractor		23
x.	CIPHET- Banana comb cutter		25
xi.	Manufacturing of Fruit squashes, Dehydrated vegetables and fruit bars	SLIET	26
3.	Technologies under Cereals & Grains processing sector		
xii.	Quinoa enriched cereal bars	PAU, Ludhiana	29
xiii.	Wadi making machine	CIPHET, Ludhiana	32
4.	Other Technologies		
xiv.	Fibre incorporated probiotic kulfi- a healthy frozen dairy dessert.	PAU, Ludhiana	35
xv.	Power-cum- Hand Operated Eight Frame Radial Honey Extractor.		37
xvi.	Electric-cum- Battery Heated Honey Wax Uncapping Knife		39
xvii.	Honey Heating-cum-Filtration System		41
xviii.	Live Fish Carrier System and Method of Transportation of Live Fish Therein	CIPHET, Ludhiana	43
xix.	Groundnut Based Flavoured Beverage, Curd and paneer	PAU, Ludhiana	45
xx.	Indigenous Pilot Plant for Production of Protein isolates from De-oiled Cakes	CIPHET, Ludhiana	47
xxi.	Turmeric Washing cum polishing Machine		48
xxii.	Cryogenic Spice Grinding System		50
xxiii.	Makhana Processing		52
xxiv.	Autoclavable microencapsulation system with multistage break up two fluid nozzle for clean production of microcapsules.		55

BACKGROUND

BACKGROUND

The document on “Agri-Food Technology Inventory of Punjab” has been developed by Punjab State Biotech Corporation under Project “Setting up of Secondary Agriculture Entrepreneurial Network in Punjab- (Phase I)” supported by Department of Biotechnology-Biotechnology Industry Research Assistance Council (DBT-BIRAC), New Delhi. SAEN is a strategic initiative launched by BIRAC in collaboration with Govt. of Punjab for Early translation Acceleration from Primary to Secondary Agriculture by promoting new enterprises and supporting existing industry in agri-food sector in Punjab. The network was launched by Honorable Chief Secretary Punjab & Secretary Department of Biotechnology, Govt. of India on 29th June 2018. Under this project unmet needs of Fruits & vegetable and Cereal & Grain Processing Industries were identified and addressed through S&T interventions in the form of short-term industry linked projects. One of the objectives of the project included the mapping of technologies and research leads available with the R&D Institutes/Organizations in Agri- food processing sector having commercial & competitive potential.

The leading Research Institutions of Punjab were contacted to seek the required information on well-structured proforma to explore the Technologies and Research Leads available with them. The details received for 24 major technologies/ S&T interventions available with Punjab Agricultural University (PAU) Ludhiana, Sant Longowal Institute of Engineering & Technology (SLIET), Longowal and Central Institute of Post-Harvest Engineering and Technology (CIPHET), Ludhiana have been compiled up in this document for the benefit of Entrepreneurs and Enterprises involved in secondary agriculture.

The document includes the technologies covering Fruits & Vegetable, Cereal & Grains, Dairy, Meat Poultry & Fish, and Confectionary sectors on aspects viz. production, processing, preservation, packaging, quality management, etc.

PSBC thankfully acknowledges the support of Universities and Research Institutes in compilation the ‘Agri-food Technology Inventory of Punjab which not only represents the state’s R&D strength in relevant domain but shall also serve as a networking platform for technology transfer/licensing between Research Institutions and Start-ups/Entrepreneurs/industries.

**FRUITS
&
VEGETABLES PROCESSING
TECHNOLOGIES**

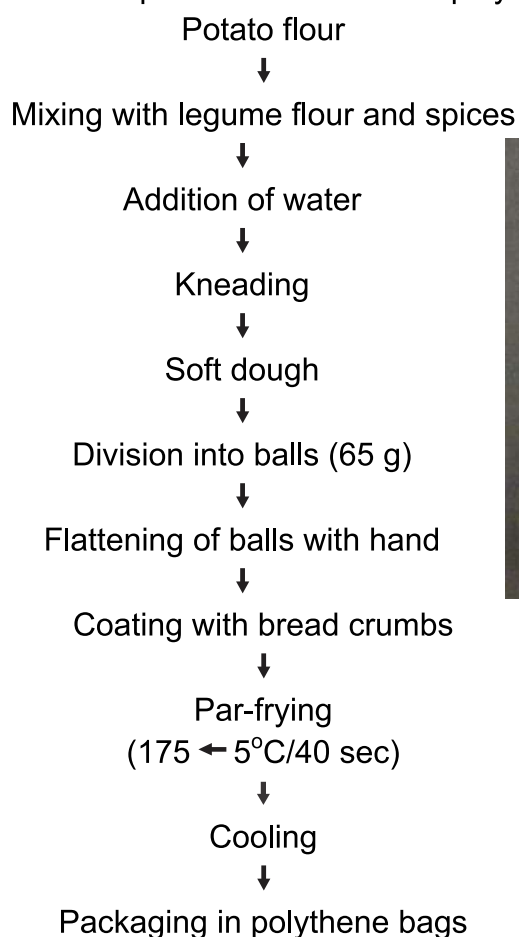
I. PREMIX FOR READY TO FRY POTATO SNACKS

1. **Name of the Institute:** Punjab Agriculture University, Ludhiana.
2. **Application/Use:** Ready to fry premix for potato *shammi kebabs*
3. **Year of development/release:** 2015
4. **Name of the Scientist/Inventor:** Dr. Poonam A. Sachdev, Dr. Amarjeet Kaur

5. Details of the Technology (Max 250 words)

- **Process overview detail & flowchart:**

Potato varieties (Kufri Chipsona-1, Kufri Chandramukhi, Kufri Pukhraj) were used for preparation of premix for ready to fry potato legume based shammi kebab. Potatoes were washed, peeled and cut into thick slices followed by drying in hot air cabinet dryer (40-50°C) to prepare dehydrated flour. Potato flour was then mixed with standardized quantities of legume flour (defatted soy and Bengal gram) along with various spices. Lukewarm water (200 ml) was added into the above mix and kneaded till the ingredients got uniformly mixed. Small balls were prepared and Par-fried in a deep fat fryer maintained at $175 \pm 5^\circ\text{C}$ for 40 sec. After frying, the kebabs were cooled, packed and sealed in polyethylene pouches.

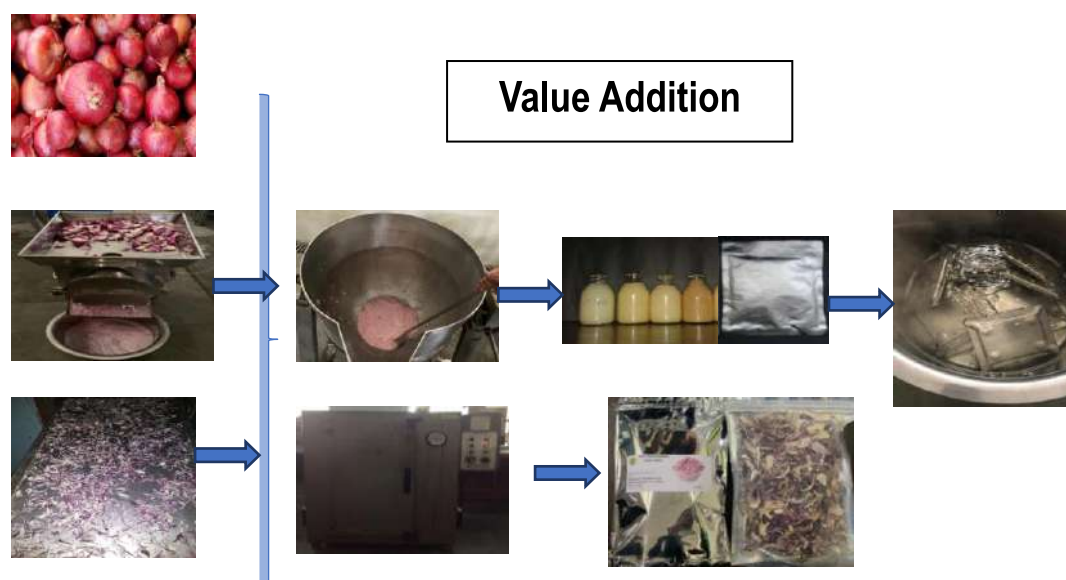


- **Scale of Development:** Commercial scale
 - **Relevant pictures of prototype/equipment/products**
 - **Novelty & Significance:**
 - a. Medium and high sugar potato varieties were used for the preparation of premix which is otherwise rendered unfit for processing.
 - b. This is a convenient ready to fry snack which provide convenience to the consumers by restricting the kitchen drudgery and time involved in the preparation of the product.
- 6. Raw material:** Potato flour, legume flour (defatted soy flour, Bengal gram flour) and dry spices
- 7. Equipment/Machinery:** Washer, peeler, mixer, packaging machines
- 8. Status of Commercialization:** White Gold Foods Pvt Ltd, Jalandhar, Punjab
- 9. Critical Requirements for implementation of technology/ process:** Quality raw material, maintenance of hygiene and sanitary conditions as per FASSAI.
- 10. Total Cost involved (including Unit Set up & Operational)/Indicative cost:**
Medium scale-40 lakhs.
- 11. Minimum Economic unit size:** 1000 sq feet (50 feet X 20 feet)
- 12. Contact details for Correspondence:** 9855055871

II. TECHNOLOGY FOR PROCESSING AND PACKAGING OF SHELF STABLE ONION PRODUCTS

1. **Name of the Institute:** Punjab Agriculture University, Ludhiana.
2. **Application/Use:** These onion products are ready to use conveniences products to be used for various food preparations i.e. Curried Vegetables, Soups and parantha mix.
3. **Year of development/release:** 2017
4. **Name of the Scientist/Inventor:** Principal Investigator: Dr. Poonam A. Sachdev
5. **Details of the Technology (Max 250words)**

- **Process overview detail &flowchart:**



- **Scale of Development:** Commercial scale
- **Relevant pictures of prototype/equipment/products:** --
- **Novelty:** Onions can be processed into ready to use onion puree and paste which can be stored for more than 6 months at room temperature. These products provide convenience to the consumers by restricting the kitchen drudgery and time involved in the preparation of the product. Onion paste and puree can be utilized in the preparation of curried vegetarian and non-vegetarian dishes. Technology of dehydrated onion flakes has 12 months shelf life, when reconstituted retain the fresh like flavor and can be further used in curried preparations and for making onion based snacks. The processed onion products can be prepared when onions are cheap and

utilized in off-season when onion prices are high.

- **Significance:** Low cost technologies: Convenient ready to use shelf stable quality products.

6. Raw material: Onion and packaging material

7. Equipment/Machinery: Washer, slicer, grinder and dryer

8. IPR (any patents filed/granted): Research papers published

9. Status of Commercialization:

Private Sector:

M/s Samarpal, Ladowal , Ludhiana

Public Sector: Received request from:

Mr. Damanpreet Singh

M/s Iqbal Singh Sodhi & Sons, Mr. Paramjit Singh

10. Critical Requirements for implementation of technology/ process:

Maintenance of hygienic and sanitary conditions right from the raw material to final product while keeping in view the safety guidelines of FSSAI and availability of quality raw material.

11. Total Cost involved (including Unit Set up & Operational)/Indicative cost:

Pilot to Small scale- 10 -12 Lacs. (without any land cost)

12. Minimum Economic unit size: 900 sq. feet (30 X 30 feet minimum) for housing the equipment only. Whereas for storage of raw material, finished products and office extra area 800-900 sq. Feet will be required.

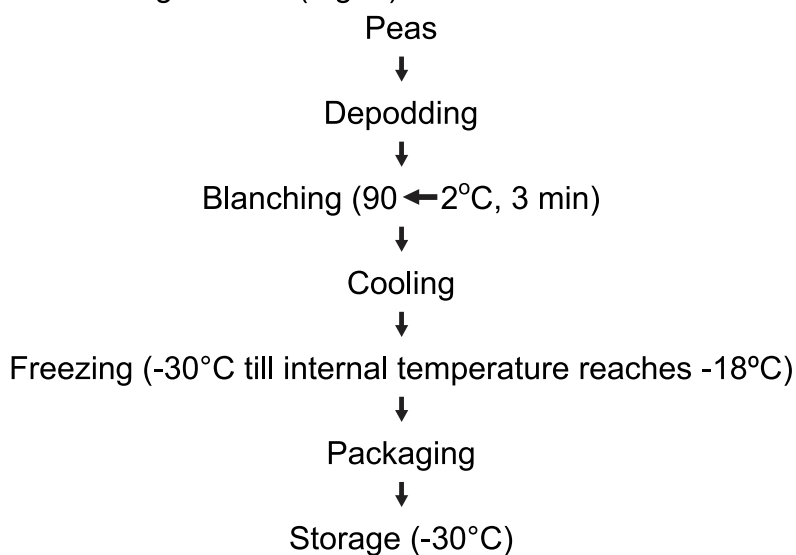
13. Contact details for Correspondence: 098550-55871

III. FROZEN POTATO AND FROZEN VEGETABLE TECHNOLOGY

1. **Name of the Institute:** Punjab Agriculture University, Ludhiana
2. **Application/Use:** Ready to use frozen vegetables with shelf life of more than one year at -18 degrees.
3. **Year of development/release:** 2019
4. **Name of the Scientist/Inventor:** Dr. Poonam A. Sachdev, Dr. Sukhpreet Kaur
5. **Details of the Technology (Max 250 words)**

➤ **Process overview detail & flowchart**

Peeled vegetables were washed and blanched to inactivate the enzymes which cause browning. The vegetables were then frozen at -30°C using blast freezing technology. Frozen peas were prepared using the following method (Fig. 1)



- **Scale of Development:** commercial scale.
- **Relevant pictures of prototype/equipment/products**



➤ **Novelty:**

- a) Near to fresh technology.
- b) These are convenient ready to use foods which can be used in the preparation of curried vegetables and specialty products such as *Aloo tikki*, *paranthas* and other snacks .

6. Raw material: Fresh peas and potatoes

7. Equipment/Machinery: Desheller, dicer, blancher, cooler, IQF, Packaging machines.

8. Status of Commercialization: The process technology was commercialized to F-Tech Foods, Miller. Technology given for mass production under the brand name “Frisky”.

9. Critical Requirements for implementation of technology/ process: Quality raw material, maintenance of hygiene and sanitary conditions as per FASSAI.

10.Total Cost involved (including Unit Set up & Operational)/Indicative cost: Medium scale-2 crores.

11.Minimum Economic unit size: 6000 sq feet (20X 300) including processing and storage area.

12.Contact details for Correspondence: 9855055871.

IV. TECHNOLOGY FOR READY TO SERVE SHELF STABLE BOTTLED SUGARCANE JUICE

1. **Name of the Institute:** Punjab Agriculture University, Ludhiana.
2. **Application/Use:** Ready to serve bottled sugarcane juice with shelf stability more than one year at ambient room temperature.
3. **Year of development/release:** 2015
4. **Name of the Scientist/Inventor:** Principal Investigator: Dr. Poonam A.Sachdev, Co Principal Investigator: Dr. Amarjeet Kaur and Er. Karanvir Gill

5. **Details of the Technology (Max 250words)**

a. **Process overview detail &flowchart:**



b. **Scale of Development:** Commercial scale

c. **Novelty:**

- Shelf stable for more than one year at room temperature.
- Packed with natural antioxidants from mint, ginger and lime juice.
- No added synthetic color, flavor and chemical preservatives

d. **Significance:** Rich in minerals (calcium, chromium, cobalt, copper, magnesium, manganese, phosphorous, potassium, zinc, iron) and vitamins (Vitamin A, C, B1, B2, B3, B5, and B6), phytonutrients, antioxidants, proteins and soluble fiber.

6. **Raw material:** Sugarcane, mint, ginger, lemon and spices.
7. **Equipment/Machinery:** Washer, juice extractor and bottling line
8. **IPR (any patents filed/granted):** Research papers published
9. **Status of Commercialization:**
 - Public Sector: Markfed, Sugarfed
 - Private Sector:
MoA Signed
 - ✓ M/s Cane-O Blast, Aurangabad
 - ✓ M/s Upright Foods and Beverages Pvt. Ltd, Bihar
 - ✓ M/s Kaveri Power Industries, Haryana
 - ✓ M/s RVG Agro Pvt. Ltd, Maharashtra

- ✓ M/s M.R. Enterprises , Karnataka
- ✓ M/s Sri Om Sai Sugar and Allied Products Pvt. Ltd., Karnataka
- ✓ Mrs. Deepa Aggarwal Ganguli and Mr. Sujit Ganguli, Vesu, Surat
- ✓ Mr. Gopal Jadav, District Gir Somnath (Gujarat)
- Other Stakeholders
- ✓ M/s Agrineer Foods, Ludhiana
- ✓ M/s Royalicious Sugarcane Juice, Rajpura

10.Critical Requirements for implementation of technology/ process:

Maintenance of hygienic and sanitary conditions right from the raw material to final product while keeping in view the safety guidelines of FSSAI.

11.Total Cost involved (including Unit Set up & Operational)/Indicative cost:

- Pilot scale- 15 Lacs. & Medium scale- 65-70 Lacs (without any land cost)
- Operational Cost- 2 Lacs for Pilot Scale and 5 Lacs per month for Medium Scale

12.Minimum Economic unit size: 900 sq. feet (30 X 30 feet minimum) for housing the equipment only. Whereas for storage of raw material, finished products and office extra area 800-900 sq. Feet will be required.

13.Contact details for Correspondence: 098550-55871

V. FARM LEVEL FRUIT & VEGETABLE WASHING MACHINE

1. **Name of the Institute:** Punjab Agriculture University, Ludhiana.

2. **Application/Use:**

3. **Year of development/release:** 2005

4. **Name of the Scientist/Inventor:**

5. **Details of the Technology (Max 250 words)**

a. **Process overview detail & flowchart:**

A stainless steel, portable, electric power (1 hp) operated vegetables washing machine has been designed, developed and evaluated. The inner rotary drum of the washer is made of stainless steel with 1.5 mm thickness, 760 mm length and 620 mm diameter. The periphery of the drum is provided with perforations of 6 mm diameter each @ 20 per 100 cm. The drum is mounted between two bearings through a hollow shaft and stainless steel pipe carrying water is placed inside the shaft. Pressurized sprays of water with a water injection pump through the central, perforated inner shaft is provided for extensive washing. The machine is provided with a timer and an electronic device to regulate precisely the rotational speed of the drum up to 60 rpm. Proper arrangements for feeding water into machine and draining out dirty water and silt is provided. Rotating parts and moving belts are covered with guard for operational safety.

b. **Scale of Development: Number of units sold/established:** 32.

c. **Relevant pictures of prototype/equipment/products**



d. **Significance:**

- Time saving
- Labour saving
- Hygienic washing
- Low washing cost

6. Raw material: Suitability of Machine wrt. to Carrot, Potato, Raddish, Turnip, Ginger, Okra, Tomato, Spinach, Turnip, Kinnow, Pears.

7. Equipment/Machinery:

8. IPR (any patents filed/granted):

9. Status of Commercialization: Smallholders Farmers (0-2 ha), Agri Entrepreneurs.

10. Critical Requirements for implementation of technology/ process:

Crop	Region
Carrot, potato, raddish, turnip, ginger, okra, tomato, spinach, turnip, kinnow and pears	Vegetable growing states i.e Punjab, West Bengal, Andhra Pradesh, Madhya Pradesh, Odisha, Uttar Pradesh etc.

11. Total Cost involved (including Unit Set up & Operational)/Indicative cost:

Unit cost of operation: Rs 80/- per hour or Rs 0.3 per kg (@8 hrs/day)

12. Minimum Economic unit size:

- Output capacity : 1 - 6 qph
- Unit cost of operation: Rs. 1-10/q
- Efficiency: 90.2-95.5%

13. Contact details for Correspondence: (Addresses of Licensee/ Manufacturer)

- M/s AB Engineers, Focal Point, Ludhiana
- Paradise Engg. Corp., 392, Industrial Area-A, Ludhiana-141 003, INDIA

14. Other relevant information (if any):

Dimension details	
Overall dimension	860 x 760 x 1140 mm
Weight	200 kg
Man power	1
Land	4 x 4m
Purpose of Technology (Single/combined use)	Single
Type of energy used by Technology (Manual/Diesel/Petrol/Hybrid)	Electrical

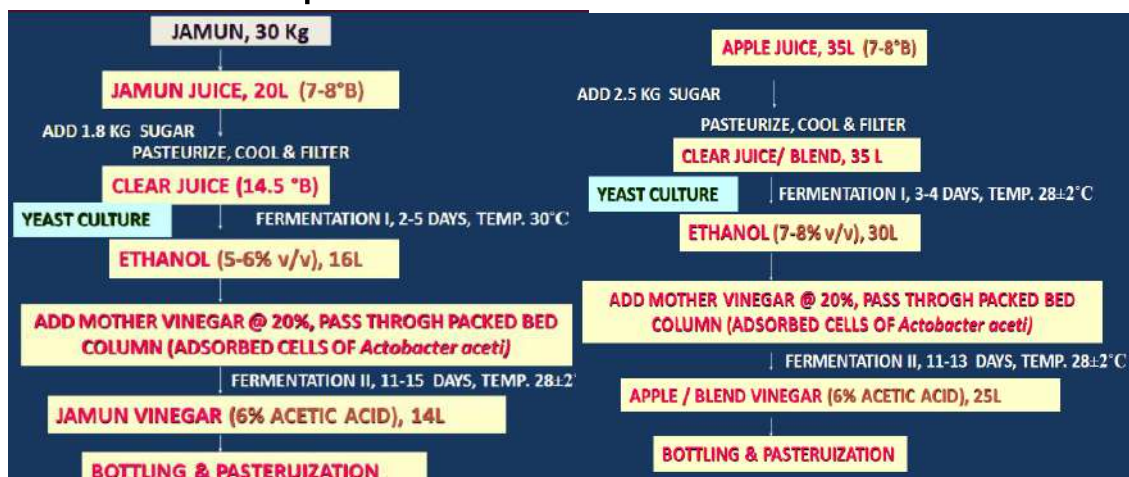
VI. BREWED FRUIT VINEGAR TECHNOLOGY

1. **Name of the Institute:** Punjab Agriculture University, Ludhiana.
2. **Application/Use:** Brewed fruit vinegar is a condiment used in pickles and salads. It is also regarded as nutraceutical due to its beneficial health effects.
3. **Year of development/release:** 2015 and 2018,
4. **Name of the Scientist/Inventor:** Dr. G.S. Kocher
5. **Details of the Technology (Max 250words)**

- **Process overview detail &flowchart**

Take fresh fruits like grapes, jamun and wash them in warm water containing 0.01% KMS and then in boiled and cooled water. Extract the juice in juicer. Pasteurize the juice and then dispense the juice in the HDPE fermenters already washed with boiled water and add KMS @ 0.01% (5g/50L) immediately after extraction. Check the brix of juice and adjust it to 15°B by adding sugar. Using the slant of *S.cerevisiae*, prepare its 2.25 L (7.5% v/v) inoculum in pasteurized (70°C, 10 min) juice. For this, active inoculated culture should be incubated at 28-30°C for 24 h with shaking. Add the prepared yeast inoculum in juice taken in the fermentation container and keep the fermentation vessel at 25°C for 4-5 days, during which alcoholic fermentation is completed. This is indicated by cessation of bubbling and settled sediment at the bottom. Keep the vessel undisturbed for two days at 10-15°C. Siphon the clear alcoholic wort and check its alcohol content. Put KMS @ 0.1% (w/v) and tightly close the alcoholic wort. Put this wort in 50L HDPE column packed with *A. aceti* cells adsorbed on wood shavings and charge it with alcohol mixed with mother vinegar in a ratio of 3:2, so as to have an initial acidity of 2% (w/v). Collect the vinegar with 6 % (w/v) acidity from the column after 10-12 days and fill it in the bottles. Pasteurize the bottles at 60-65°C for 20 min. and store.

- **Scale of Development: 25L Scale**



- **Relevant pictures of prototype/equipment/products**



- **Novelty**
Fruits for vinegar fermentation being seasonal are not available throughout the year but vinegar prepared from these may be used all round the year.
- **Significance**
Natural vinegar is a food product of increasing significance by virtue of its widely variable origin and is recommended by Food Safety and Standards Authority of India as a condiment and food preservative.

6. Raw material: Fruits

7. Equipment/Machinery: HDPE Fermenters

8. IPR (any patents filed/granted): Indian Patent (No. 291923) has been obtained for production of concentrated sugarcane vinegar in 2018

9. Status of Commercialization: Commercialized. FiveMoAshave been signed with industries in and outside the state.

10. Critical Requirements for implementation of technology/process: Vinegar inoculums: Yeast for alcoholic fermentation and bacteria for acetic acid fermentation.

11. Total Cost involved (including Unit Set up & Operational)/Indicative cost: Rs. 1,50,000/- (approx.) at commercial scale (1000 L/mo.)

12. Minimum Economic unit size: s. 10,000/- (approx.) at domestic scale (100 L/mo.)

13. Contact details for Correspondence: Dr. G.S. Kocher, Principal Microbiologist-cum-Head, Department of Microbiology, COBS&H, PAU Ludhiana.

14. Other relevant information (if any): Nil

VII. LOW ALCOHOLIC NATURALLY CARBONATED (LANC) BEVERAGE PRODUCTION TECHNOLOGY FROM FRUITS, VEGETABLES AND ITS BLENDS (AMLA, PLMS, GUAVA, GRAPES, CARROT)

1. **Name of the Institute:** Punjab Agriculture University, Ludhiana.
2. **Application/Use:** A preservative free, reliable, fermented nutraceutical rich (niacin, pyridoxine, thiamine, riboflavin, rutin, quercetin, ferulic acid, caffeic acid) fruity mocktail to be used in parties and marriage ceremonies.
3. **Year of development/release:** 2006 and 2009
4. **Name of the Scientist/Inventor:** Dr. (Mrs.) Param Pal Sahota
5. **Details of the Technology (Max 250 words)**

- **Process overview detail & flowchart**

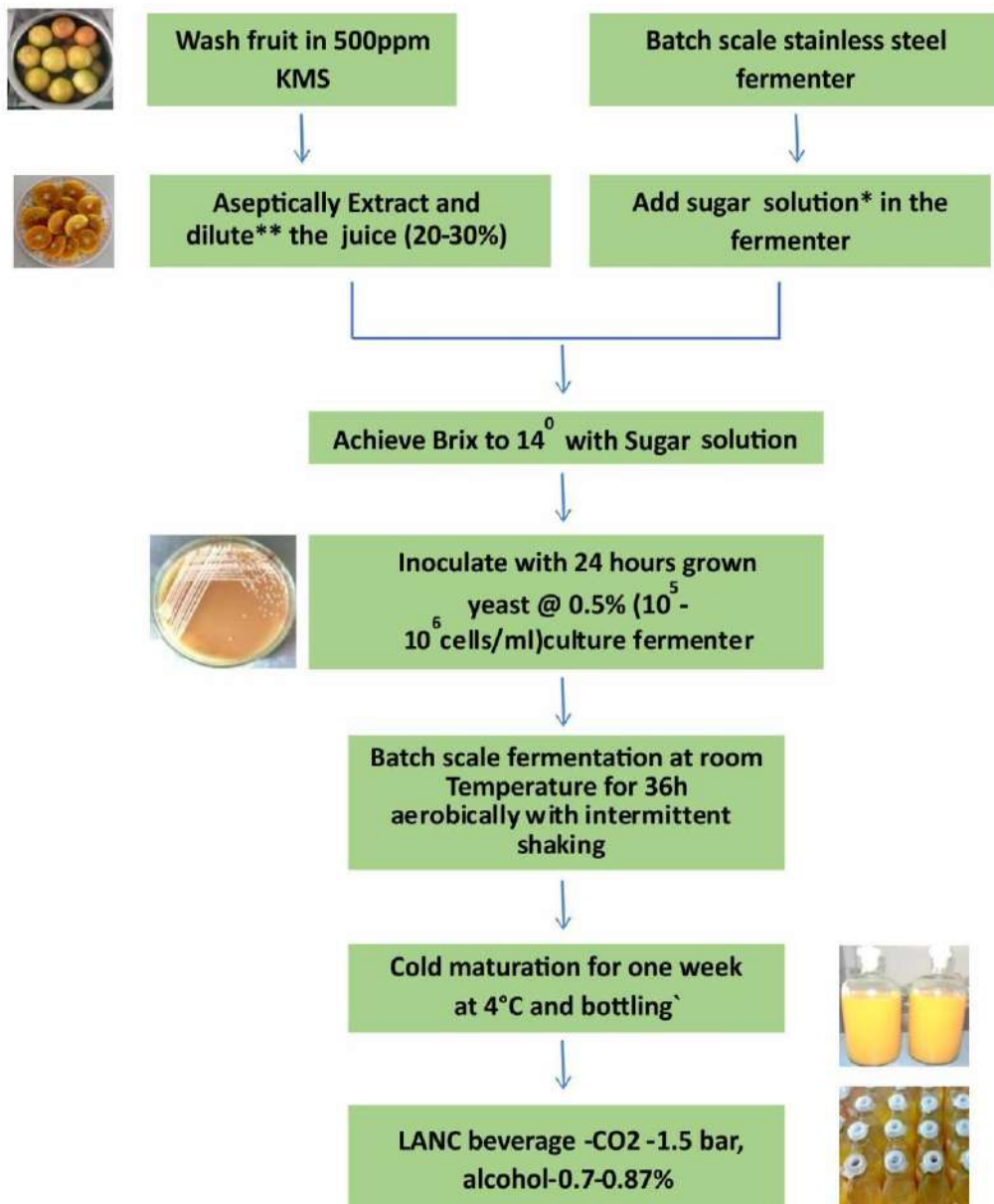
A reliable, reproducible technology for production of low alcoholic naturally carbonated fermented beverage has been optimised by fermenting fruit juice with novel yeast, *Clavispora lusitaniae* has been isolated from Feta cheese, which was prepared by inoculating the starter mesophilic culture (Choozit 230, Bulk cultures; Danisco, Niebull, Germany) containing *Lactococcus lactis* subsp. *lactis* and *Lactococcus lactis* subsp. *cremoris*, and thermophilic yoghurt culture (YO-MIX 532, Bulk cultures; Danisco, Niebull, Germany) containing *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus* and characterized molecularly and biochemically in the Department of Microbiology, Punjab Agricultural University. This novel yeast has the potential to ferment fruit juice from plums, lemon, guava, and vegetables carrot and Indian goose berry for production of LANC beverage. The bioprocess optimised for parameters Brix, BAR, Titrable acidity, the final fermented beverage has alcohol concentration less than 1.0% v/v and 1.5 bar pressure of Carbon dioxide. This yeast follows Neuberg III pathway for catalysis of sugars in low pH juices. Low alcoholic is term used to justify the concentration of alcohol <1% and Carbon dioxide naturally produced during fermentation imparts fizz, tangy taste, antimicrobial and super critical solvent properties. It is a simple, minimally processed, optimized batch scale microbial fermentation with incubation period of 36 hours with a cost of Rs. 20/100mL.



TECHNOLOGY FOR THE PRODUCTION OF LOW ALCOHOLIC NATURALLY CARBONATED (LANC) BEVERAGES



Process Requirements: Yeast culture, Fruit (citrus fruits like kinnow, lemon, grapefruit, Big lime, sweet lime, plum, guava, amla, grapes and pineapple), Batch scale fermenter, Sugar.



*With Boiled & cooled Sugar Solution

- **Scale of Development:** 100 L Scale
- **Relevant pictures of prototype/equipment/products**



•**Novelty**

- A batch scale simple, reproducible, preservative free fermentation technology. The yeast act as natural flavour enhancer through fermentation process. This technology can redress the problem of fruit glut during the season, avoiding the economic losses and providing a new product (fruity mocktail). This can be adopted by entrepreneurs.

•**Significance**

- Beverage is endowed with nutraceuticals, niacin, pyridoxine, thiamine, riboflavin, rutin, quercetin, ferulic acid and caffeic acid. It is free from preservatives and retains nutraceutical properties

6. Material: Fruits, vegetables (amla, plms, guava, grapes, carrot) or blends

7. Equipment/Machinery: Nil

8. IPR (any patents filed/granted): Indian Patent (No. 305767) has been obtained for process for production of non-alcoholic naturally carbonated beverage in 2019

9. Status of Commercialization: Commercialized. The Unati Co-operative Marketing-cum-processing Society Ltd., Talwara

10. Critical Requirements for implementation of technology/process: Yeast inoculum: *Clavispora lusitanae*.

11. Total Cost involved (including Unit Set up & Operational)/ Indicative cost: Rs. 1,00,000/- (approx.) at commercial scale (1000 L/mo.)

12. Minimum Economic unit size: Rs. 10,000/- (approx.) at domestic scale (500 L/mo.)

13. Contact details for Correspondence: Dr. (Mrs.) Param Pal Sahota, Principal Microbiologist-cum-University Librarian, Department of Microbiology, COBS&H, PAU Ludhiana.

14. Other relevant information (if any): Nil

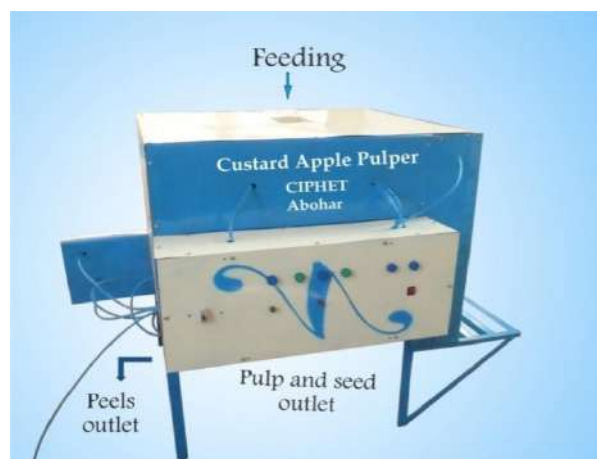
VIII. AUTOMATIC CUSTARD APPLE PULPER

1. **Name of the Institute:** CIPHET, Ludhiana.
2. **Application/Use:** Custard apple fruits are very delicate and pulp extraction is tedious process. Getting intact pulp and separating peels and seeds are being done manually and very unhygienic process. To overcome this problem an automatic machine for separating the peels, seeds and the intact pulp from custard apple fruits has been developed. It is very easy to use and operated with very less power and man power.
3. **Year of development/release:** 2011
4. **Details of the Technology (Max 250 words):**

- **Process overview detail & flowchart:**

The custard apple pulper contains three mechanism viz. fruit cutting mechanism, fruit scooping mechanism and pulping mechanism. Fruit cutting and scooping mechanism are made with pneumatic actuators and electronic controls. This invention is fully automatic machine assisted with pneumatic power and electronically controlled. The capacity of the cutting and scooping mechanism is 120Kg/hr and efficiency: 94% pulp recovery, 6% pulp wastage along with peels. The capacity of pulping mechanism is 120Kg/hr and efficiency: Coarse / Intact Pulp recovery: 70-72%; Fine Pulp recovery: 28-30% Advantages include:

- The existing tribal farmers who already involving cultivation, they will get higher price for their raw material.
- For farmers, it is going to help to get high economic value and slowly custard apple cultivation will become organized farming.
- For food processing industries, this machine would help them to develop new products out of custard apple and get good market value.
- For consumers, by new and diversified product from custard apple, it is going to give them new palatability and nutritionally enriched product.



- 5. IPR (any patents filed/granted):** Patent No. 334054
- 6. Status of Commercialization:** Commercialized to
- Mr. Shivananad M. Shelge,
 - M/s Nexgen drying systems,
 - # C902 Sigma One building,
 - Pune - 411038 Mobile-9822651535
- 7. Total Cost involved (including Unit Set up & Operational)/Indicative cost:** 10 lakh
- 8. Contact details for Correspondence:** Director, ICAR-CIPHET, PO PAU-Ludhiana-141004.

IX. CIPHET-POMEGRANATE ARIL EXTRACTOR

1. **Name of the Institute:** CIPHET, Ludhiana.
2. **Application/Use:** There is no mechanical method or machine is commercially available for safe separation of arils from the Pomegranate. Since a Pomegranate contains several hundreds of arils completely held within the fruit, manual processing of pomegranates consisting of cutting the fruit by knife into pieces and then separation of arils tends to be very inefficient and highly labour intensive, time consuming and irritating. Arils are so firmly attached to each other and; with rind and peel that it makes difficult to separate manually for industrial processing in large quantity. The present system is mechanical and continuous system for safe separation of arils from the Pomegranate fruit for its industrial processing.
3. **Year of development/release:** 2008
4. **Details of the Technology (Max 250 words):**
 - **Process overview detail & flowchart:**

It is a mechanical and continuous system for processing of whole Pomegranate of any size, shape and variety; and for recovery of clean, whole and undamaged arils. The system comprises the essential components such as Pomegranate Fruit Breaking unit, Drive unit, Collection Trays where separated arils and extraneous matters are received, Vibrating Sieve unit; and the clean arils and extraneous matter Collection Troughs. The fruit breaking unit consists of innovative mechanisms with knives arrangement to continuously break the fruit in such a way that the major portion (85-90%) of arils is safely separated out from the broken peels. The rest of the arils that is about 10-15% remains attached with the peels are further getting separated over the vibrating screen designed specifically for this purpose. The machine is capable to process the whole pomegranate at a rate of approximately 30-35 fruits per minute with extraction capacity of 90-94% and with little damage of arils that is about 2-4%. The main advantages of this machine are that the whole Pomegranate breaking and arils separation mechanism is highly efficient with little damage and waste. The machine provides continuous operation for rapid processing of large quantities in any shape, size and variety of the Pomegranate. The peels and other extraneous matter are separated out and yielding clean arils that can be used for further processing or for fresh eating/marketing.
 - **Specifications and advantages:**
 - Higher aril extraction capacity that is around 5.0 quintal per hour (approximately 35-40 fruit per minute)

- Aril extraction/separation efficiency is in the range of 90-94% depending on variety and Pomegranate characteristics
- Mechanical damage received by arils is only 2-4%
- 2-3 persons man power required for safe and smooth running
- Electrical power required- 0.75 kW (1.0hp)



5. Raw material: Established workshop etc.

6. IPR (any patents filed/granted): Patent No. 293135

7. Status of Commercialization: Commercialized to

- M/s Padmatech Engineering Systems Plot No. 236 Sector No. 7 PCN TDA, Bhosari Pune-411 026
- Email-padmatechengg@yahoo.com

8. Critical Requirements for implementation of technology/ process:

9. Total Cost involved (including Unit Set up & Operational)/Indicative cost: 20 lakh

10. Contact details for Correspondence: Director, ICAR-CIPHET, PO PAU-Ludhiana-141004

X. CIPHET- BANANA COMB CUTTER

1. **Name of the Institute:** CIPHET, Ludhiana.
2. **Application/Use:** Banana-Comb/hand Cutter” can be used instead of a sickle for separating banana-comb/hand from banana bunch.
3. **Year of development/release:** 2008
4. **Details of the Technology (Max250 words):**

- **Process overview detail & flowchart:**

Banana-Comb/hand Cutter” can be used instead of a sickle for separating banana-comb/hand from banana bunch. This simple tool is suitable for all sizes of banana bunch stem and manually placing the tool and putting little pressure from top achieves cutting. CIPHET Banana-Comb/hand Cutter maintains smooth cutting curve of banana-comb/hand, with no fruit damage during cutting (as in case of knife or sickle cutting, some banana-finger getting damaged). This tool is suitable for all sizes of banana bunch stems. One person is required to perform the banana-comb/hand cutting activity with less stress.

- **Advantages:**

- Help to reduce post-harvest losses up to 6%,
- Reduce human drudgery and save time.



5. **Status of Commercialization:** Commercialized to
i. M/s. National Agro Industries, Ludhiana
6. **Contact details for Correspondence:** Director, ICAR-CIPHET, PO PAU-Ludhiana-141004

XI. MANUFACTURING OF FRUIT SQUASHES, DEHYDRATED VEGETABLES AND FRUIT BARS.

1. **Name of the Institute:** Sant Longowal Institute of Engineering & Technology (*SLIET*), Longowal
2. **Application/Use:** Fruit and vegetable processing and product
3. **Year of development/release:** Past few years
4. **Name of the Scientist/Inventor:** Professor Kamlesh Prasad
5. **Details of the Technology (Max 250 words):**
 - Fruits and vegetable are among the category of protective food group. The processed products like fruit squashes as ready to prepare beverages are common and relished during summer season. Some of the fruits available locally or required in the region could find profitable for the involved entrepreneurs. In its preparation fruit juice or pulps are used along with sweeteners and other ingredients to help in preservation and improving the acceptability.
 - At the same time the dehydration of commonly grown vegetables may be suitable option for the any one being higher shelf life of such products and variety in its use. The process involves the use of suitable dehydration equipment for removal of moisture from the subjected vegetables to a safe limit protecting the nutrient and sensory attributes to its maximum.
 - The fruit bars as a common confectionary item are also popular among all the age group as ready to eat product. This product is prepared from the fruit pulp applying the dehydration technique.
6. **Raw material:** Fruits and Vegetables
7. **Equipment/Machinery:** Processing Machineries, Dryers, etc.
8. **Status of Commercialization:** Functioning
9. **Critical Requirements for implementation of technology/ process:** Antioxidant activity, phenolic, carotenoid and color changes in packaged forms.
10. **Total Cost involved (including Unit Set up & Operational)/Indicative cost:** Depending of the capacity of plant to setup.
11. **Minimum Economic unit size:** Processing line capacity: Variable and as per requirement.
12. **Contact details for Correspondence:** Professor (Dr.) Kamlesh Prasad (Phone No.: 9417741225)

**CERERALS
&
GRAINS PROCESSING
TECHNOLOGIES**

XII. QUINOA ENRICHED CEREAL BARS

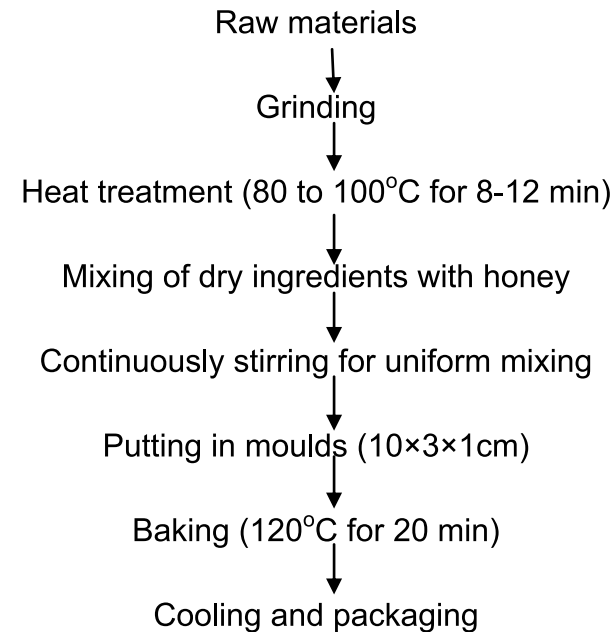
1. **Name of the Institute:** Punjab Agriculture University, Ludhiana.
2. **Application/Use:** Snack for celiac patients and good for weight loss.
3. **Year of development/release:** 2017
4. **Name of the Scientist/Inventor:** Dr. Preeti Ahluwalia, Dr. Poonam A.Sachdev
5. **Details of the Technology (Max 250words)**

Quinoa is a pseudo cereal which is used like cereals and is rich in the essential amino acid lysine, fiber, iron, magnesium, calcium, copper, phosphorus, vitamin E, vitamin B, omega-3 and 6 fatty acids as well as carbohydrates (low glycemic index) and phytosterols. It is a gluten-free so the celiac patients as well as who are allergic to wheat can include it in their diet. Quinoa, amaranth, arrowroot, millets, rice etc. are the best option to develop gluten-free diet. World production of quinoa has grown approximately from 46,000 to 80,000 MT in last ten years. The price of quinoa has increased dramatically over the past 10 years due to its high demand. The quality of protein in quinoa is better than other cereals and vegetables and also cooked quinoa has higher PER (protein efficiency ratio) value as compared to uncooked quinoa. Carbohydrates of quinoa also act as a nutraceutical food and have various physiological health effects, such as: provision of energy, effects on gastric emptying and control of blood glucose, insulin metabolism, protein glycosylation, cholesterol and triglyceride metabolism. Quinoa as such has a slightly bitter taste which is difficult to consume as such. In form of bar its bitter taste can easily be masked by the use of honey. Four cereal bar formulations were developed, namely F1, F2, F3 and F4 and the amounts of quinoa, brown rice and flax seed varied among the formulations. Honey was added at different levels (40%, 50% and 60%) to all the four formulations. Then based on sensory evaluation final product was selected. F1 constituted of 35% quinoa, 25 % brown rice, Flaxseed 25%. F2 had 35% quinoa, 30 % brown rice, Flaxseed was 20%. F3 40% quinoa, 30 % brown rice, 15% Flaxseed. To F4 40% quinoa, 35 % brown rice, 10% Flaxseed was added. To the each formulation almonds, dried figs and raisins were added at the level of 5% each.

- **Process overview detail & flowchart:**

Cereal bar was prepared using quinoa, brown rice and flaxseed along with honey as a binder and sweetener Dry heat treatment was given to quinoa (Fig. 3.2), brown rice (Fig. 3.3) and flaxseed (Fig. 3.4) at a temperature 80-100⁰ C for 8-12 min prior to use in preparation of bar. The honey used as a binding agent. The cereal bar was prepared by mixing dry ingredients with honey. The dry ingredients were incorporated into honey and the mass was kept under

constant stirring until completely homogenized. Stainless steel spoon was used for stirring. The mass was moulded into non stick stainless steel mould having dimension $10 \times 3 \times 1$ cm. Then the bar was kept in oven at 120°C for 20 min and bar was allowed to cool before packaging.



Flow sheet for the preparation of cereal bar

- **Scale of Development:** The technology is applicable for small scale industry.
- **Relevant pictures of prototype/equipment/products:**



Raw and Roasted Quinoa



Raw and Roasted Brown Rice



Raw and Roasted Flax seed



Multi grain cereal bar



- **Novelty:** The quinoa grain was used in a nutrition bar after removing of bitterness for enhancing the phytochemicals in then cereal bar. Moreover the combination of the grains used viz.quinoa, brown rice and flaxseeds along with honey was unique which has not been used so far.
 - **Significance:** These days there is a lot of emphasis on use of coarse grains for enhancing the nutritional status of the people. That is why the quinoa was used in the bar as it is a rich source of protein, calcium and antioxidants. The bars are easy to consume one bar can be consumed to replace one meal. It very good for diabetics and celiac patients.
8. **Raw material:** Quinoa, Brown rice, Flaxseed, honey, dried figs, almonds and raisins.
 9. **Equipment/Machinery:** Barley pearler, drier,mixer steam jacketed kettle for roasting the grains, packaging machine, boiler.
 10. **IPR (any patentsfiled/granted):** Paper published: Kaur R, Ahluwalia P, Sachdev P A, Kaur A (2018) Development of gluten free cereal bar for gluten intolerant population by using quinoa as major ingredient. *J. Food Sci. Technol.* 55:3584–3591
 11. **Status of Commercialization:** Already commercialized (CRS Farms Ludhiana).
 12. **Critical Requirements for implementation of technology/process:** The grain quinoa is bitter in taste because of the presence of saponins. The outer layer of the grains has to be removed and the grain has to be washed for two to three times to make the grain edible and the quality of product acceptable. Proper process has to be followed for removal od bitterness from quinoa.
 13. **Total Cost involved (including Unit Set up & Operational)/Indicative cost:**
For small scale the equipment cost is Rs. 15 lacs, 2lacs would be operational cost.
 13. **Minimum Economic unitsize:** 25x25 sq.ft.
 14. **Contact details for Correspondence:** Dr.Poonam A Sachdev, Head Department of Food Science and Technology

XIII. WADI MAKING MACHINE

1. **Name of the Institute:** CIPHET, Ludhiana.
2. **Application/Use:** For production of different varieties of wadi
3. **Year of development/release:** 2018
4. **Name of the Scientist/Inventor:**
5. **Details of the Technology (Max 250 words):**
 - **Process overview detail & flowchart:**

Wadi are generally prepared from pulses after soaking and grinding and thereafter forming small sized balls followed by drying in sun, commercially. This not only leads to unhygienic way of manufacturing but also takes more time, labour as well as causes human drudgery. Besides, the wadis obtained are not of uniform in shapes and sizes. It is a traditional product and is also being exported outside India but lacks the aesthetic appeal. So, hygienic way of production and formation of different shapes, uniform size wadi will definitely have greater marketing potential than the existing wadis. The developed machine completely eliminates the hand operation thereby reducing drudgery and further contributing to food safety. The capacity of the machine is estimated to be 150-300 kg/h which depends upon the weight of wadi to be made. The machine produces nine different shapes of wadi which will definitely increase the consumer appeal for the traditional product. The developed machine is an initiative in mechanizing the production of Indian traditional foods.
6. **Equipment/Machinery:** Established workshop etc.
7. **Status of Commercialization:** Commercialized to
 - i. M/s Empire Bakery Machines Pvt. Ltd.,
opp.Gurudwara Somasar Sahib Vill.Tibba
P.O., Sahnewal, Punjab – 14112011.
8. **Total Cost involved (including Unit Set up & Operational)/Indicative cost:**
15 lakh
9. **Contact details for Correspondence:** Director, ICAR-CIPHET, PO PAU-Ludhiana-141004.

OTHER TECHNOLOGIES

XIV. FIBRE INCORPORATED PROBIOTIC *KULFI* - A HEALTHY FROZEN DAIRY DESSERT

1. **Name of the Institute:** Punjab Agriculture University, Ludhiana.
2. **Application/Use:** It will be a useful as a health food. Hence it can taken by small, large and medium scale industry dealing with manufacture of health food.
3. **Year of development/release:** January 2019
4. **Name of the Scientist/Inventor:** Dr. Jaspreet Kaur, Dr. Poonam A. Sachdev, Dr. Amarjeet Kaur
5. **Details of the Technology (Max 250 words)**

a. Process overview detail & flowchart:

Milk was standardized to 5.5 per cent fat from full fat (6 per cent fat) and double toned milk (1.5 per cent fat) using Pearson's square method. Milk was then condensed to one half of its volume and sugar was added @ 10 per cent w/v of the mix. Oat bran was roasted and cooked in condensed milk for 15 minutes. Stabilizer (sodium alginate; @ 0.4% w/v of the mix) was added to this condensed milk, followed by addition of skim milk powder (@8 % w/v of the mix). This mix was aged for 3-4 hrs at $4\pm1^{\circ}\text{C}$ followed by inoculation with *Lactobacillus casei* (NCDC 358) at 37°C . The inoculated *kulfi* mix was incubated for 4 hrs at 37°C . Freezing of the mix was done by traditional method by agitating in an earthen pot containing ice-salt mixture in the ratio 4:1 for 25 ± 5 min. The frozen *kulfi* was hardened in a cabinet freezer at $-18\pm1^{\circ}\text{C}$ for 10-12 hrs and stored at this temperature.

b. Scale of Development: Small to medium scale

c. Relevant pictures of prototype/equipment/products



Fibre incorporated probiotic *kulfi*

- d. Novelty:** Probiotic *kulfi* has not yet been commercialized in our country
- e. Significance:** The oat bran incorporated probiotic *kulfi* would be beneficial to for the health of consumers as it contains the required count of viable bacteria that are needed for providing the health benefits that

probiotics confer on the host individual. Moreover, the consumer is also likely to be benefitted from the dietary fibre. This prebiotic effect of fibre may additionally help in viability and growth of prebiotic bacteria. This would provide a healthier alternative to the traditional dairy product, *kulfi*.

6. **Raw material:** Standardized milk, skim milk powder, sugar, oat bran, Lactobacillus casei culture, sodium alginate
7. **Equipment/Machinery:** Steam heated vessel/ Concentrator, Incubator, Refrigerator, *Kulfi* freezer, Deep freezer
8. **IPR (any patents filed/granted):** Nil
9. **Status of Commercialization:** Yet to be commercialized
10. **Critical Requirements for implementation of technology/ process:**
 - Pure culture
 - Incubator for activation of culture, Laminar flow,
 - Hygienic plant area,
 - Good quality raw material (milk, sugar, stabilizer etc.),
 - *Kulfi* freezer, good refrigeration facilities with continuous electricity supply
11. **Total Cost involved (including Unit Set up & Operational)/Indicative cost:**
Unit cost of *kulfi* manufacture: Rs. 180.18 per kg
12. **Contact details for Correspondence:**
 - a. Dr. Jaspreet Kaur
 - b. Food Technologist, Department of Food Science and Technology, Punjab Agricultural University, Ludhiana.

XV. POWER-CUM- HAND OPERATED EIGHT FRAME RADIAL HONEY EXTRACTOR.

1. **Name of the Institute:** Punjab Agriculture University, Ludhiana.

2. **Year of development/release:** 2005

3. **Details of the Technology (Max 250 words)**

a. **Process overview detail & flowchart:**

The extractor was so designed that it could be operated both manually as well as through 0.5 hp electric motor. The body of the extractor is made up of 22 gauge stainless steel sheet, having eight frames radially arranged at an angle of 45° to the central shaft for fast and easy extraction. A strainer is fitted just below the frames for primary filtration. It can store upto 1qtl of honey.

b. **Scale of Development:** Number of units sold/established (50)

c. **Relevant pictures of prototype/equipment/products**



d. **Significance:**

- Easy operation and hygienic
- Reduces time
- Reduces drudgery

4. **Raw material:** Honey combs

5. **Status of Commercialization:** Agri Entrepreneurs.

6. **Critical Requirements for implementation of technology/ process:**

Crop	Region
Honey	Punjab, Haryana, Himachal Pradesh, UP, Bihar and West Bengal

7. Total Cost involved (including Unit Set up & Operational)/Indicative cost:

- Unit cost (per machine) : Rs. 45,000/-
- Unit cost of operation : Rs 20/Qtl
- Operating cost per hour: Rs 44.06/- (@8hr/day)

8. Minimum Economic unit size: 180-190 kg/hr, Units of energy required, 0.4/hr.

9. Contact details for Correspondence:

1. M/s AB Engineers, Focal Point, Ludhiana
2. Tiwana Bee Farm, G.T Road, Doraha , Ludhiana (Addresses of Licensee / Manufacturer)

10. Other relevant information (if any):

Dimension details	
Overall dimension	805 x 805 x 1310 mm
Weight	106 kg
Power	0.5 hp
Man power	2
Land	1x 1 m
Purpose of Technology (Single/combined use)	Single
Type of energy used by Technology (Manual/Diesel/Petrol/Hybrid)	Electrical/Manual

XVI. ELECTRIC-CUM- BATTERY HEATED HONEY WAX UNCAPPING KNIFE

1. **Name of the Institute:** Punjab Agriculture University, Ludhiana.

2. **Year of development/release:** 2009

3. **Details of the Technology (Max 250 words)**

a. **Process overview detail & flowchart:**

The electrically-cum-battery heated uncapping knife has been designed to uncapping the wax seals on the comb cells. The design is based on the dimensions of the frame over which the wax sheet containing the cells is present. The total length of knife is 37.5 cm comprising of 25.4 x 6.5 cm knife blade of 0.2 cm thick MS sheet. A fine nichrome wire is used for the heating element (of 1 amp. Current rating) on a 13 x 3.5 cm mica sheet. It has facilities to operate both on 220 V AC supply as well as 12 V DC power supply.

b. **Scale of Development:** Number of units sold/established: 35

c. **Relevant pictures of prototype/equipment/products**



d. **Significance:**

- Time saving
- Hygienic
- Reduces Drudgery

4. **Raw material:** Honey comb frame filled with honey

5. **Status of Commercialization:** Agri Entrepreneurs.

6. **Critical Requirements for implementation of technology/ process:**

Crop	Region
Honey	Punjab, Haryana, Himachal Pradesh, UP, Bihar and West Bengal

7. Total Cost involved (including Unit Set up & Operational)/Indicative cost:

Output Capacity: 18-22 sec/single frame, Unit cost of operation: Rs. 0.5/frame

8. Minimum Economic unit size: 100 frames/hr, Units of energy required 0.125/hr.

9. Contact details for Correspondence: M/s AB Engineers, Focal Point, Ludhiana (Addresses of Licensee/ Manufacturer)

10. Other relevant information (if any):

Dimension details	
Overall dimension	238 x 71 x 3 mm (Knife blade)
Weight	542 gm
Man power	1
Land	Working place for one person
Purpose of Technology (Single/combined use)	Single
Type of energy used by Technology (Manual/Diesel/Petrol/Hybrid)	Electrical/Battery

XVII. HONEY HEATING-CUM-FILTRATION SYSTEM

1. Name of the Institute: Punjab Agriculture University, Ludhiana.

2. Year of development/release: 2013 (REC APPROVED 2018)

3. Details of the Technology (Max 250 words)

a. Process overview detail & flowchart:

This is a fully mechanized Honey Filtration Unit with separate heating and filtration arrangements having two separate sensors for sensing and controlling the temperature of heating water as well as honey in the main chamber. It consists of two sections; the top heating section and the lower filtering section. The heating section consists of a double walled cylinder and two electric heating elements, each of 2 kW fixed in the space in between the outer and inner cylinder filled with water which is heated by heating element provided. In addition a separate pipe is provided for filling/ unfilling of water in/from the system which is attached with a tullu pump for recirculating the water causing turbulence thus helping in maintaining uniform temperature of water used for indirect heating of honey. In order to have uniform temperature profile throughout the heated honey an electrically operated six fins stirrer was attached which is operated by 0.25 hp motor, stirring the sample at optimum speed as and when required. The heated honey is passed to the filtration unit through the hole provided at the bottom of the inner cylinder and extended through a pipe having gate valve. The filtration section consists of the stainless steel cylinder having Strainer mesh of 200 micron stainless steel sieve and a motor to filter at the rate of 10 litre of honey per minute.

b. Scale of Development: Number of units sold/established: 42

c. Relevant pictures of prototype/equipment/products



d. Significance :

- Time saving
- Hygienic operation
- Reduces Drudgery
- Energy Saving

4. **Raw material:** Suitability of Machine wrt. Honey

5. **Status of Commercialization:** Agri Entrepreneurs.

6. **Critical Requirements for implementation of technology/ process:**

Crop	Region
Honey	Punjab, Haryana, Himachal Pradesh, UP, Bihar and West Bengal

7. **Total Cost involved (including Unit Set up & Operational)/Indicative cost:**

Unit cost (per machine): Rs. 75,000 and Unit cost of operation: Rs. 75/- per hr or Rs. 3.0/Kg

8. **Minimum Economic unit size:** 50 Kg/ batch (nearly 2 hour), Unit of energy required, per hour (2.5

9. **Contact details for Correspondence:** M/s AB Engineers, Focal Point, Ludhiana (Addresses of Licensee/ Manufacturer)

10. **Other relevant information (if any):**

Dimension details	
Overall dimension	686 x 686 x 1524 mm
Weight	110 kg
Man power	1
Land	1 x 1m
Purpose of Technology (Single/combined use)	Single
Type of energy used by Technology (Manual/ Diesel/ Petrol/Hybrid)	Electrical

XVIII. LIVE FISH CARRIER SYSTEM AND METHOD OF TRANSPORTATION OF LIVE FISH THEREIN

1. **Name of the Institute:** CIPHET, Ludhiana.
2. **Application/Use:** For transportation of live fish in the market
3. **Year of development/release:** 2016
4. **Details of the Technology (Max 250 words):**

a. **Process overview detail & flowchart:**

Live fish carrier system has two major components Self-Aerating Containers (SAC) and Battery Operated Self-Contained Aerating Vehicle (BOSCAV). Self-Aerating Containers (SAC) are stackable, easy unloading and aerating containers with approximate capacity of 10-20 kg fish/container. SAC is equipped with aerators, filters and metabolite absorbent to maintain ideal water quality for fish during transportation. SAC facilitates easy loading and unloading of fish, transportation of individual fish species with specific size separately in the same vehicle and also minimizes accident proneness. BOSCAV is operated by rechargeable 4 Lead Acid batteries, equipped with self-aerating system with a total carrying capacity of 500 kg. It can run about 60-80 km from a single charge. Driver's shed and control panel near driver seat provides single man handling facility. Solar power is used to run the aerator and filtration pumps. The vehicle run son electric (DC) power. It can transport fish with zeromortality from the farmers pond to market covering distance up to 50-60 km with an average speed of 20 km/h, as batteries giveback up for a travel of about 80 km per recharge.

b. **Relevant pictures of prototype/equipment/products:**



- 5. Equipment/Machinery:** Established workshop etc.
- 6. IPR (any patents filed/granted):** Patent application no. 201611032728
- 7. Status of Commercialization:** Commercialized to
- i. M/s E-Magic Electric, Nangla Fateh Khan,
PO- Patara, Jalandhar (Punjab)- 144101,
Mob: 09914702070
- 8. Total Cost involved (including Unit Set up & Operational)/Indicative cost:**10 lakh
- 9. Contact details for Correspondence:** Director, ICAR-CIPHET, PO PAU-Ludhiana-141004

XIX. GROUNDNUT BASED FLAVOURED BEVERAGE, CURD AND PANEER

1. **Name of the Institute:** CIPHET, Ludhiana.
2. **Application/Use:** Groundnut milk based products can play an important role in combating malnutrition.
3. **Year of development/release:** 2009
4. **Details of the Technology (Max 250 words)**

a. **Process overview detail & flowchart:**

- Manufacturing of groundnut based flavoured beverage, curd and paneer is carried out by firstly extracting peanut milk. The process involves the steps of de-skinning peanut, steaming in autoclave, soaking in water, grinding of peanut kernels with hot water, filtration and then peanut milk is ready. Then for the preparation of peanut flavoured beverage other ingredients are added and milk is homogenized. Flavour is added after cooling and peanut flavoured beverage is ready for bottling. The process of peanut paneer involves boiling of peanut milk followed by coagulation, filtration through double layer muslin cloth, hanging for separation of whey, pressing under paneer pressing machine and then finally cutting into desired cube size. The developed products are excellent in taste and rich in nutritional quality. Imitation milks like peanut milk may serve as a boon for the countries where the supply of milk is inadequate. In developed countries, imitation milks can save the masses as heart ailments, which are considered safer than saturated fatty acid. Peanut milk based products can play an important role in combating malnutrition. So, the present low level in its consumption, especially in the developing countries, should be increased.

b. **Relevant pictures of prototype/equipment/products**



5. **Raw material:** Groundnut, Milk powder, Sugar, flavour etc.
6. **Equipment/Machinery:** Groundnut decorticator, Tray dryer, Vessels, Autoclave, Soy/groundnut processing plant with deodorizer and filtration unit, Homogenizer, Weighing balance, Capping machine, Chest freezer, Paneer pressing machine, Sealing Machine, Cup filling machine, Incubator, etc.

7. IPR (any patents filed/granted): NA

8. Status of Commercialization: Commercialized to:

- a. Mr. Kulvinder Singh 35, Tower, Phase II Jalandhar
- b. Mr. Amarjeet Singh Kohli 70, Kamala Nehru Nagar Bathinda
- c. Mr. Mahinder Singh Vill.Kauri, PO Khanna Dist. Ludhiana
- d. Sh. Baldev Raj S/o Sh. ChanderLal, GaliAtama Singh Wali, Tarntaran
- e. Mr. Sandeep Garg S/o Sh. Krishna Lal, 12A/82 Shiv PuriDhuri Dist. Sangrur
- f. Mrs. Sarbjit Kaur W/o Mr.Sukhjinder Singh, No. 60, satnam Colony, alipur Road, Mithapur, near Bhatti Cold Store, Jalandhar (Punjab)-144 006
- g. Mr. Dilbag Singh, St. No. 13/10, Guru Gobind Singh Nagar, Opp. Antic Resort, Bathinda, (Pb.) -151 001
- h. Mr. Sat Pal Singla, 39/2, Bharat Nagar, Bathinda (Pb.) -151 001
- i. Mr. Uttam Singh, # 19330, St. – 5, Guru TegBahudur Nagar, BibiWala Road, Bathinda, (Pb.) -151 001
- j. Mr. Inderjit Singh, S/o Late S. Daljit Singh, H. No. 5501, St. No. 6, Sahibzada Fateh Singh Nagar, New Shimlapuri, Ludhiana – 141003
- k. Mr. Gaurav Modi S/o Mahesh Chand Modi, Modi House Telipada Morena MP
- l. Mr. Satyam Mahajan S/o Dr DD Mahajan, Nutan Nagar, Khargone, MP
- m. Mr. Suyash Shukla, S/o Mr.Sushil Kumar Shukla, 145, Sai Baba Nagar, 60 Feet Main Road, Dwarikapuri, Indore (M.P.) – 452 009
- n. Piyush Vyas, Shree Geeta Industries, G.I.D.C-II, Plot No. 1889, Junagadh – 362 003, Gujarat
- o. Mr.Govind Narayan Aggarwal S/o Lalita Prasad Aggarwal, Dausa, Rajasthan.
- p. Mr.MunishShadija Symphony Tradecom. Pvt. Ltd. Raipur, Rajasthan
- q. Mr. Chandra Pal Jain S/o Sh. Mohan Lal Jain, 27, MithlaPuri, Phase-III, Delapeer, Bareilly(U.P).
- r. S. Daljit Singh, s/o S. Kirpa Singh, VPO Akkanwali, Tehsil Tohana, Distt. Fatehabad (Haryana) – 125 106
- s. Mr. Dinesh Soni, s/o Sh. Satish Kumar Soni, D-26, DDA Flats MIG, Saket, New Delhi – 110 017.

9. Total Cost involved (including Unit Set up & Operational)/Indicative cost:
8 lakh (depends on capacity)

10.Contact details for Correspondence: Director, ICAR-CIPHET, PO PAU-
Ludhiana-141004

XX. INDIGENOUS PILOT PLANT FOR PRODUCTION OF PROTEIN ISOLATES FROM DE-OILED CAKES

1. **Name of the Institute:** CIPHET, Ludhiana.

2. **Year of development/release:** 2019

a. **Process overview detail & flowchart:**

- The concept of producing protein isolates from available de-oiled cakes/meals (groundnut, soybean, mustard, sunflower etc.) using indigenous optimized process and equipment or pilot plants assumes importance in Indian scenario. The protein isolates/concentrates can be used to produce different protein fortified health foods, so that the cost of protein supplemented foods may be reduced and be within the reach of large population of the country. In India, more than 50% children and 36% adults suffer from various degrees of protein malnutrition. The imported protein products available in the market cost high and are not in the economic reach of large segments of Indian population. In Indian market, only milk protein and soy proteins are available. India manufactures milk/whey protein but cost is high. Further, India imports soy protein from China, USA and Brazil which also cost high. The available protein isolate plants in foreign countries are based on their own design for high capacity and with high cost. Consequently, these are not suitable for small entrepreneurs of our country.

b. **Relevant pictures of prototype/equipment/products**



3. **Raw material:** Oilmeal etc.

4. **IPR (any patents filed/granted):** Patent application no. 201911021833

5. **Status of Commercialization:** Yet to commercialize.

6. **Total Cost involved (including Unit Set up & Operational)/Indicative cost:** 3 Crore.

7. **Contact details for Correspondence:** Director, ICAR-CIPHET, PO PAU-Ludhiana-141004

XXI. TURMERIC WASHING CUM POLISHING MACHINE

1. **Name of the Institute:** Punjab Agriculture University, Ludhiana.

2. **Year of development/release:** 2008

3. **Details of the Technology (Max 250 words)**

a. **Process overview detail & flowchart:**

Turmeric rhizomes can be mechanically washed as well as polished in a, portable, electric power (1 hp) operated, rotary drum type turmeric washing and polishing machine. The stainless steel drum is 62 cm in diameter and 61 cm in width with 6mm holes and is provided with a timer and an electronic device. The machine when operated at optimum performance parameters, i.e. 40 rpm for 5 min, can wash 2.5-3.0 qph of turmeric rhizomes. The same machine can be used for polishing turmeric by use of three detachable perforated screens (0.91 mm) of G.I. sheets, attached along the inner periphery of the drum. The optimum performance parameters for polishing are 40 rpm for 20 minutes with a capacity of 1 qph.

b. **Scale of Development:** Number of Units sold/ established- 30

c. **Relevant pictures of prototype/equipment/products**



d. **Significance:**

- Time saving
- Labour saving
- Hygienic washing

4. **Raw material:** Suitability of Machine wrt Turmeric.

5. **Status of Commercialization:** Smallholders Farmers (0-2 ha), Agri Entrepreneurs.

6. Critical Requirements for implementation of technology/ process:

Crop	Region
Turmeric	Andhra Pradesh, Tamil Nadu, Punjab, Rajasthan, Orissa, Maharashtra, Assam, Kerala, Karnataka and West Bengal

7. Total Cost involved (including Unit Set up & Operational)/Indicative cost:

Operating cost: Rs 82/- per hour or Rs 0.3 per kg (for washing) and Rs 0.8 per kg (for polishing) [@8 hours per day]

8. Minimum Economic unit size:

- Unit of Energy, per hour (0.75),
- Turmeric Washing (Capacity 2.5-3.0 qph),
- Turmeric Polishing (Capacity 1 qph).

9. Contact details for Correspondence: Addresses of Licensee/ Manufacturer

- M/s AB Engineers, Focal Point, Ludhiana
- Paradise Engg. Corp., 392, Industrial Area-A, Ludhiana-141 003, INDIA

10. Other relevant information (if any):

Dimension details	
Overall dimension	860 x 760 x 1140 mm
Weight	200 kg
Man power	1
Land	4 x 4m
Dimensions of Drum	Diameter 62cm, W-61cm, with 6mm holes
Purpose of Technology (Single/combined use)	Combined
Type of energy used by Technology (Manual/Diesel/Petrol/Hybrid)	Electrical
<i>Turmeric Washing</i>	
Optimum speed	40 rpm
Time	5 min
Microbial washing efficiency	91%
<i>Turmeric Polishing</i>	
Optimum speed	40 rpm
Time	20 min
Microbial load reduction	50%

XXII. CRYOGENIC SPICE GRINDING SYSTEM

1. **Name of the Institute:** CIPHET, Ludhiana.
2. **Application/Use:** For cryogenic grinding of spices to get good quality spice powder
3. **Year of development/release:** 2013
4. **Details of the Technology (Max 250 words):**

a. **Process overview detail & flowchart:**

- Spices are most important constituents of food and cuisines especially in India. These are used not only in households, but also in hotels, restaurants, eateries and food processing industries. The fat content of spices poses problems due to temperature rise to the extent of 42-95°C and sieve clogging takes place during grinding. Due to this temperature rise, spices lose a significant fraction of their volatile oil or flavoring components. Advantages of cryogenic grinding of spices are: less loss of volatile content, improved flavour, reduced heat generation, improved colour, improved size reduction, fine powder, improved grinding operation, improved particle size distribution and increased production rate etc.

b. **Scale of Development**

Designed system grinds the spices at ultra-low temperature, thereby maintaining their flavor and medicinal properties. The grinding system consists of a self-pressurized liquid nitrogen cylinder (185 liter capacity), cryo-pre-cooler (capacity: 30-50 kg/h; feed material size: 1 to 10 mm); a grinder / dual mill (pin mill and provision of hammer mill) with variable grinder speed.

c. **Relevant pictures of prototype/equipment/products**



- 5. Raw material:** Spices etc.
- 6. Equipment/Machinery:** Established workshop etc.
- 7. IPR (any patents filed/granted):** NA
- 8. Status of Commercialization:** Commercialized to
i. M/s Spectra Cryogenic Systems Pvt. Ltd. H-326(E), Road No. 6, IPIA, Kota, Rajasthan
- 9. Total Cost involved (including Unit Set up & Operational)/Indicative cost:**
25 lakh
- 10. Contact details for Correspondence:** Director, ICAR-CIPHET, PO PAU-Ludhiana-141004

1. **Name of the Institute:** CIPHET, Ludhiana .
2. **Application/Use:** Processing and value addition of makhana
3. **Year of development/release:** 2008
4. **Details of the Technology (Max 250 words):**

- a. **Process overview detail & flowchart:**

Makhana is highly nutritious, fully organic non-cereal food superior to dry fruits such as almonds, walnut, coconut and cashewnut in term of sugar, protein, ascorbic acid and phenol content. The makhana is washed by the raw makhana seed washer and kept for drying up to 24 hours. After drying the makhana seeds are graded by using raw makhana seed grader having 6 types of sieve size varying from 7mm-16mm. After grading the different grades are stored in separate gunny bags for further processing operation. The graded makhana is roasted in developed roaster for several minutes depending upon the size of makhana seeds. Roasted makhana are allowed to cool. After cooling the roasted makhana is popped in Makhana popping machine which consists of inlet/feeder/hopper, roaster, decorticator and outlet. Popping is entirely based on the amount of moisture present in the makhana seed. The popped makhana is collected and graded in popped makhana grader machine which is having 3 grades viz 15mm, 20mm and 30mm. In India, makhana is mainly consumed in popped (roasted and fried) form. Fried makhana with salt or sugar are very widely used as snack foods. Vegetable curry of makhana is one of the most delicious preparations. Makhana occasionally is utilized for milk based food preparations like kheer and puddings at household level in Mithilanchal region of North Bihar using crude and non-standard methods. CIPHET developed process of making ready to constitute makhana kheer mix embodied herein could be used to manufacture the same to prepare consistently high quality makhana kheer with least effort just by adding the mix into adequate hot/warm or cold water and stirring them for a while. Now a day's, demand of makhana snacks with different flavours is increasing due to its health benefits, nutritional profile and antioxidants properties. However, the conventional process of makhana snacks preparation involves the use of excessive fat or oil, which may be as high as 30% and above. Such high quantity of oil is not desirable as the excessive use of oil may reduce the shelf life. Further, such flavoured makhana may not be suitable for obese and health conscious people. The developed process comprises of a

formulation of edible spices and permitted flavouring materials, process of applying formulation to the popped makhana and method of mixing. Any kind of fat or oil or fat containing materials is not used in the developed process.

b. Relevant pictures of prototype/equipment/products



Makhana popping machine



Makhana roaster



Makhanakheer mix



Fat free flavoured makhana

5. Raw material: Makhana, flavourings, etc.

6. Equipment/ Machinery: Makhana washer, grader, roaster, popping machine, popped makhana grader, flavouring machine etc.

7. IPR (any patents filed/granted):

- Patent No. 287541: Ready to constitute makhanakheer mix
- Patent application no. 674/DL/2013: Mechanized system for popping and decortications of makhana seeds
- Patent application no. 202011037651: Mechanized System for Primary Roasting of Raw Makhana Seeds and Process Thereof,

8. Status of Commercialization:

- **Ready to constitute makhanakheer mix commercialized to**

1. Mrs.GouriMahtoC/o Raj Kumar Mahto M/S Vijay Raj Company,

BaheriDarbhanga-847105 Bihar.

2. M/s Ultra Bio Naturals 41, DIC (Baddi), Himachal Pradesh.
3. M/s A1 Foods India Pvt. Ltd., 6-2-8/3, Shivrampally, Katedhan Village, RajendranagarMandal, RR District 500 052. Telangana.
4. M/s Mithila Naturals Private Ltd., Village- Jarail-Arer, SH 52, District- Madhubani- 847223(Bihar).
5. Ms.Renu Mishra, U-173, 3rd Floor (left side), Upadhyay Block Shakarpur, Near Kotak.
6. Mahindra Bank, Shakarpur, Laxmi Nagar (East Delhi), Delhi-110092.

- **Mechanized system for popping and decortications of makhana seeds commercialized to:**

1. M/s Jwala Engineering and Consultancy Services, # 354, Sector-2, Growth Centre, Saha, Ambala (Haryana) – 133104, Ph No.- +919416367366, 91-171-2821836.
2. M/s Unitech Technocrats, Vill. MeerpurGurudwara, Kala Amb (Sirmour)- 173030 H.P.+919315175276.
3. M/s Arkeys Scientific Instruments Company, Sehore, (M.P.), 9827259642.

- **Mechanized System for Primary Roasting of Raw Makhana Seeds and Process Thereof commercialized to:**

1. M/s Unitech Technocrats, Vill. MeerpurGurudwara, Kala Amb (Sirmour)- 173030 H.P.+919315175276.

9. Critical Requirements for implementation of technology/ process:

10.Total Cost involved (including Unit Set up & Operational)/Indicative cost:30 lakh

11.Minimum Economic unit size:

12.Contact details for Correspondence: Director, ICAR-CIPHET, PO PAU- Ludhiana-141004

13.Other relevant information (if any):

XXIV. AUTOCLAVABLE MICROENCAPSULATION SYSTEM WITH MULTISTAGE BREAK UP TWO FLUID NOZZLE FOR CLEAN PRODUCTION OF MICROCAPSULES.

1. **Name of the Institute:** CIPHET, Ludhiana.
2. **Application/Use:** The Microencapsulator is designed for production of wet alginate microcapsules of bacteriocins, enzymes, probiotics and prebiotics etc. ranging in size from 1500 μm down to around 50 μm .
3. **Year of development/release:** 2011
4. **Name of the Scientist/Inventor:**
5. **Details of the Technology (Max 250 words):**
 - a. **Process overview detail & flowchart:**
 - Microencapsulation paves way for development innovative functional foods. The microcapsules are produced using two fluid glass nozzle atomizers of different configurations in which the pressurized air or inert gas is used to break up the jet of matrix fluid (solution of sodium alginate/ chitosan/ carageenan/combination of these alone along with some other filler material such as starch to impart controlled release properties). The kinetic energy of high pressure air or inert is used for breakup of matrix fluid jet. The small droplets produced fall in reaction vessel. The reaction vessel contains divalent cations or polycationic substances; which results in ionic gelification yielding microcapsules. The Microencapsulator is designed for production of wet alginate microcapsules ranging in size from 1500 μm down to around 50 μm . The products encapsulated are bacteriocins, enzymes, probiotics and prebiotics. The developed system comprises of a container for a stream matrix fluid; and a pump for delivering a programmable controlled flow of said suspension through two fluid nozzle which comprises a glass tube and at least two outer tubes coaxially surrounding the glass tube. The micro-droplets of said flow are collected into an aqueous solution containing divalent cations or polycationic substances with resulting gelification yielding microcapsules with magnetic stirrer to avoid clumping. The apparatus can also be used for emulsification and preparing emulsions of oil/lipid in aqueous solutions. The oil/lipid is pumped through liquid inlet and is broken by air coming out of concentric air outlets of nozzle.
 - b. **Scale of Development**
 - c. **Relevant pictures of prototype/equipment/products**



6. Equipment/Machinery: Established workshop etc.

7. IPR (any patents filed/granted): Patent no. 324943 tu

8. Status of Commercialization: Commercialized to
i. M/s Singh Scientific Glass Works, 266 D,
Rajguru Nagar, Ferozpur Road, Ludhiana.
ii.

9. Total Cost involved (including Unit Set up & Operational)/Indicative cost:
50 lakh

10. Contact details for Correspondence: Director, ICAR-CIPHET, PO PAU-
Ludhiana-141004.

PUNJAB STATE BIOTECH CORPORATION

C-134, Industrial Focal Point, Phase VIII, SAS Nagar (Mohali), Punjab - 160071
Phone: +91-172-5020895-96, 5093595, 5053094, 5020892, Telefax: +91-172-5020895
E-mail: pbti2005@yahoo.com; Website: www.pbtilabs.com