

Technologies/Prototypes developed at NIFTEM which are ready to be transformed into a commercial technology

NIFTEM is the brainchild of the Ministry of Food Processing Industries (MoFPI) Government of India. MoFPI in its Vision document-2015, envisaged creation of a world-class institution to cater to the various stakeholders such as entrepreneurs, food processing industry, exporters, policy makers, government and existing institution. NIFTEM will work actively for assisting in setting up food standards, businesses incubation and can also include knowledge sharing.

In line with NIFTEM's mandate to develop a low cost technology for food processing has developed the following technologies/prototypes which are available to be transformed into a commercial product and finally the technology transfer to the various stakeholders.

1. ENZYME-FREE OPTICAL NANOBIOSENSOR FOR THE DETECTION OF L-LACTATE IN FOOD SAMPLES
2. LABEL-FREE NANOSENSOR FOR TOTAL AFLATOXINS IN FOOD
3. DEVELOPMENT OF CELLULOSE NANOWHISKERS BASED BIO-DEGRADABLE FOOD PACKAGING MATERIAL USING AGRO WASTE (POTATO PEEL)
4. COCONUT WATER EXTRACTION MACHINE
5. BOONDI DISPENSER MACHINE
6. LINUS DOMESTIC REFRIGERATOR
7. EVACUATED TUBE SOLAR DRYER
8. PCM ASSISTED FLAT PLATE COLLECTOR SOLAR DRYER.
9. NIFTEM ADVANCED DRYING UNIT (NIFTEMA-DU).
10. LOW COST MEAT STORAGE STRUCTURE
11. PROTEIN RICH GRANOLA BAR

All the interested persons/Vendors/Equipment/Manufacturers/Designers are invited to be the part of the grand initiative by associating with NIFTEM for developing the commercial models of these technologies on a profits sharing basis.

Kindly contact

Sr NO	Technology	Contact Person	Email Id
1	ENZYME-FREE OPTICAL NANOBIOSENSOR FOR THE DETECTION OF L-LACTATE IN FOOD SAMPLES	Dr. P. Murali Krishna, Assistant Professor, Department of Basic and Applied Science (BAS), NIFTEM	mkprayaga1@gmail.com ,
	LABEL-FREE NANOSENSOR FOR TOTAL AFLATOXINS IN FOOD		
	DEVELOPMENT OF CELLULOSE NANOWHISKERS BASED BIO-DEGRADABLE FOOD PACKAGING MATERIAL USING AGRO WASTE (POTATO PEEL)		
2.	COCONUT WATER EXTRACTION MACHINE	Dr. Vinkel Kumar Arora, Assistant Professor, Department of Food Engineering (DFE), NIFTEM	Vinkelarora17@gmail.com
	LINUS DOMESTIC REFRIGERATOR		
	EVACUATED TUBE SOLAR DRYER		

	PCM ASSISTED FLAT PLATE COLLECTOR SOLAR DRYER		
	BOONDI DISPENSER MACHINE		
3.	NIFTEM Advanced Drying Unit (NiftEMA- DU).	Dr. Prabhat Kumar Nema, Associate Professor, Department of Food Engineering (DFE), NIFTEM	pknema@yahoo.co. in
4	LOW COST MEAT STORAGE STRUCTURE	Dr. Prarabdh C. Badgajar, Assistant Professor Department of Food Science and Technology, NIFTEM	prarabdh.niftem@gm ail.com
	PROTEIN RICH GRANOLA BAR		

1. ENZYME-FREE OPTICAL NANOBIOSENSOR FOR THE DETECTION OF L-LACTATE IN FOOD SAMPLES

Problem identified

- L-Lactate concentration plays an important role in clinical diagnostics (lactate threshold), medicine validation, and food analysis.
- Rapid determination of L-lactate is particularly important in special care units, it act as an alarm signal for the diagnosis of patient conditions.
- L-lactate levels may also indicate freshness, flavors, stability, and quality of milk & dairy products, as well as fruits, meat, vegetables, and wine.
- The food industry monitors lactate levels in the fermentation of dairy products. It has an application as a food preservative.
- Rapid enzyme-free and facile sensing method of L-Lactate in food and/or clinical sectors is not yet reported.

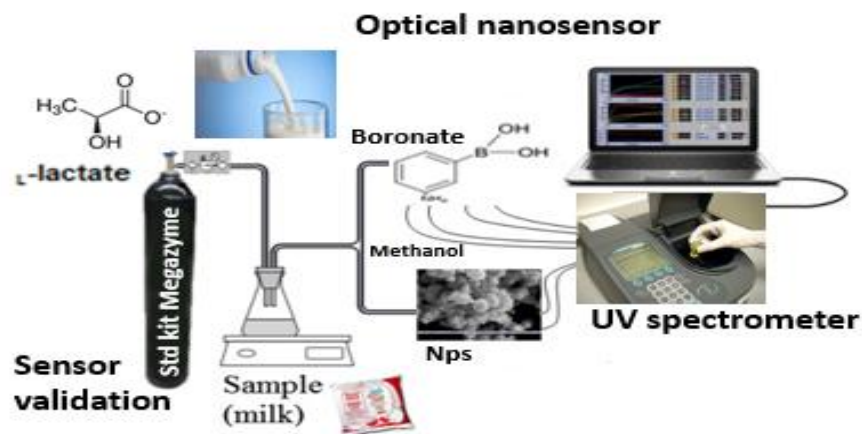
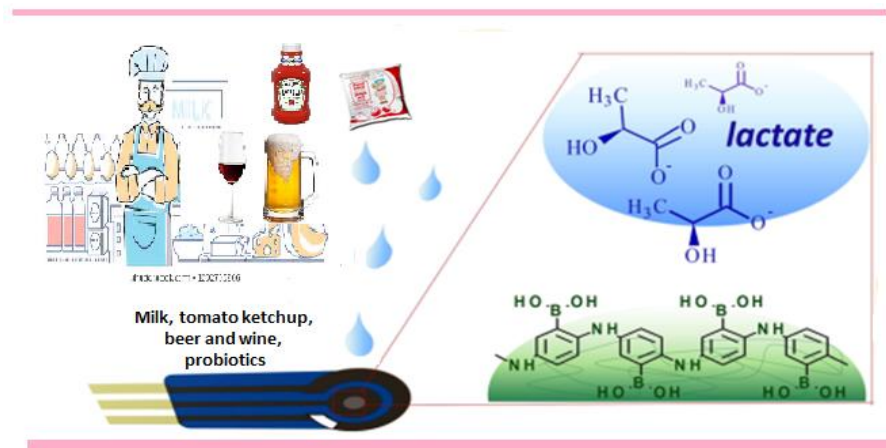


Fig: Typical L-Lactate detection sensor (Research work under progress)

Solution

- Comparatively low cost (<Rs. 200/sample) as compare to commercial enzymatic kit (Rs. 2500/sample).Further, no kits reported from any of the Indian companies.
- Enzyme-free optical sensor (facile, rapid and easy to operate).
- We are reporting first time non-enzymatic nanomaterial sensor for L -lactate detection useful to food industries like ex. milk, juices, ketchup, etc. and biomedical applications.

Methodology

- Metal and metal oxide based nanomaterials.
- Synthesis and characterization of the nanopahse.
- Selection of suitable L -lactate binding molecule; boronate salts
- L -lactate sensor optimization, standardization & LOD estimation
- Commercial food sample analysis (milk, fruit juices, tomato ketchup, beer & wine, etc.)
- Validation and verification with conventional techniques – Enzymatic standard Kit or HPLC.

Industries working for L -Lactate sensing

- Nestle India Limited (milk products)
- Mother Dairy Fruit & Vegetable Pvt Ltd (milk products)
- Kissan (ketchups)
- The Kraft Heinz company- Heinz India (ketchups)
- Chateau Indage Limited, Pune (wine industry)

Applications

- Monitoring of L -lactate level in food products is of high importance in sport medicine and for clinical diagnosis as well as for food safety and quality analysis.

- **Patent filed- supported by TIFAC, under DST, Govt. of India**
(Patent under process)

2. LABEL-FREE NANOSENSOR FOR TOTAL AFLATOXINS IN FOOD

Problem identified

- Aflatoxins (AFs) are active metabolites of fungus *Aspergillus flavus* and *A. parasiticus*. They are classified as group I carcinogen by IARC to humans, poultry, and livestock.
- Food crops affected; cereals, pulses, nuts, oilseeds, spices, etc.
- The conventional techniques are expensive, time bound, require expertise and complex instruments like HPLC, LC-MS, ELISA
- Rapid label-free techniques using nanomaterials for AFs detection would be simple, sensitive, accurate economic and on-time.
- Colorimetric detection method for onsite detection TOTAL AFs detection

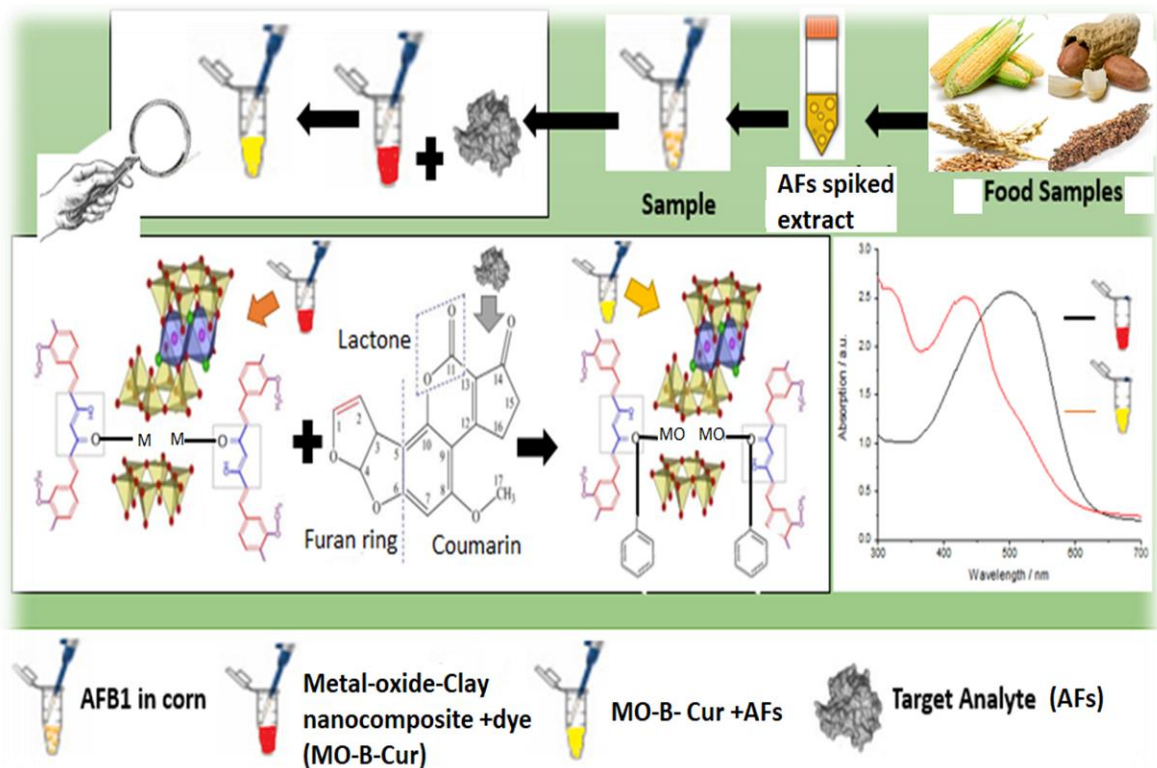


Fig: Facile and rapid colorimetric detection method for total flatoxins (AFs) in food Fig: Typical L-Lactate detection sensor (Research work under progress)

Solution

- On time sensitive optical detection for AFs in range of food products.
- Colorimetric qualitative and quantitative analysis through Hand Colorimeter and UV visible spectroscopy
- Rapid color change with AFs exposure in food products
- Least LOD value estimated with a range of nanocomposites (lowest known LOD range = 0.1- 2.5 ppb)
- Comparatively low cost (<Rs.100/per sample) as compare to commercial techniques (Rs.3000/sample and lot of sample pre processing).

Methodology

- The sensor works in aqueous as well as thin film substrate
- When AFs in food samples exposed to the sensor it cause the change in color of the reaction mixture, characterized by UV-VIS & colorimeter.
- The AFs extract of food samples was prepared in polar solvent which is studied without any further treatments for evaluation with the sensor
- The sensitivity of AFs in food samples is known from the calibration curves drawn in UV-VIS spectrometer.

Application

- Alternate to existing high cost equipments (mostly imported equipments) needs lot of pre sample processing and time consuming
- Due to low cost detection of AFs, it finds application in SME food processing units also.
- It also gives advantage to industries to monitor food spoilage in storage, harvest and pre-harvest.
- Can be employed as test strips at farmer scale to control AFs.

--Submitting for patent, work in progress---

3. DEVELOPMENT OF CELLULOSE NANOWHISKERS BASED BIO-DEGRADABLE FOOD PACKAGING MATERIAL USING AGRO WASTE (POTATO PEEL)

Problem identified

- Agro waste management and converting into green materials is challenging. Due to lack of facile techniques, huge agro waste getting unutilized at different scale of processing.
- Non-biodegradable packaging material are harmful to environment
- The low cost and effective green packaging material for food shelf life enhancement is much needed and also promote the SMEs at rural level.

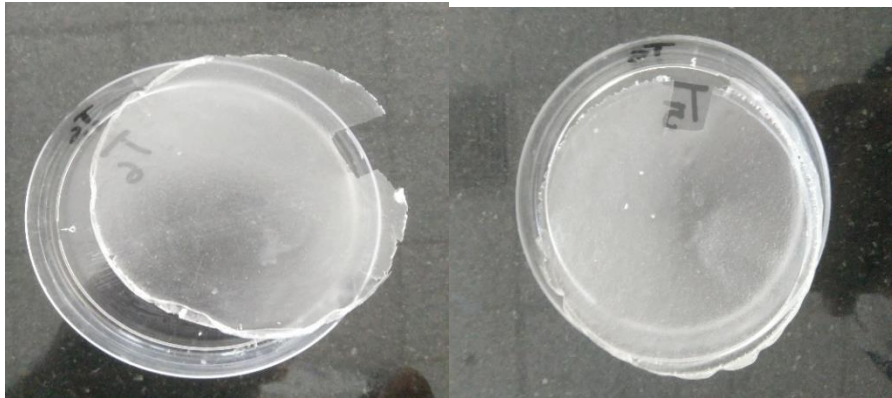


Fig 1. Bio-Degradable food packaging material using cellulose nanowhisker

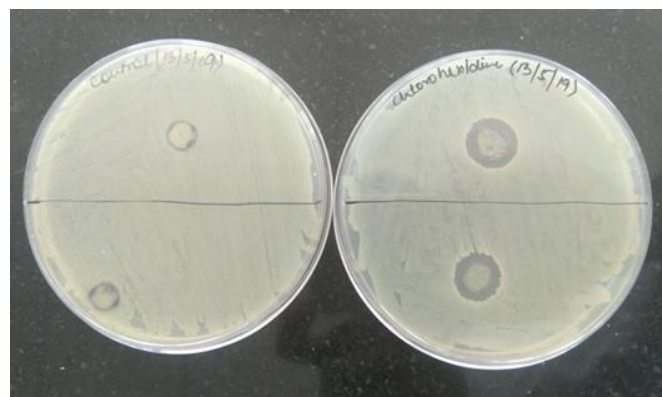


Fig 2. Antimicrobial activity of film unmodified(LHS) and modified (RHS)

Solution

- Utilization of agro waste (ex. potato peel, etc) to make cellulose nanowhisker then modified with certain gelatinizing agents and antimicrobial materials at ambient conditions would be cost effective production method and results eco-friendly packaging material.
- Characterization and optimization of bio-degradable packaging film with good barrier properties for various food applications.
- Better packaging with anti-microbial properties for perishable foods at domestic and industrial applications.
- Could be better alternate to the current plastic films

Working

- The cellulose nanowhiskers would give better barrier properties with the advantage of bio-degradability
- The addition of antimicrobial components to the film would make the effective packaging for perishable foods (trial under progress)

Application

- The low cost antimicrobial bio-degradable packaging material for the perishable foods such as fruits, vegetables, meat, Bakery and Dairy products, etc.

4. COCONUT WATER EXTRACTION MACHINE

Problem identified

- No technology for extraction of water from a mature coconut
- Manual coconut water extraction consumes time and is unhygienic
- Dewatering of coconut for dried copra.



Solution

- Comparatively low cost.
- Semi Automatic and Easy to operate.
- Hygienic and Time saving process



Working

- Removal of husk
- Centering the weakest eye by a laser beam
- Cleaning of coconut shell by nylon brush
- Piercing the weakest eye of mature coconut shell.
- Extraction of water by suction

Applications

- For commercialization of mature coconut water
 - **Patent filed Application No- 201711039165**

5. BOONDI DISPENSER MACHINE

Problem identified

- Tedious laborious job in conventional method since bondi dispensing is done manually
- Non-uniformity in boondi shape and size



Solution

- Mechanical semi-automatic aid for boondi making
- Improved efficiency and through put



- Adjustable tapping height
- Provision of different diameter sieve.

Working

- The batter is fed from hopper through a ball valve
- Sieve/ screen dispenses boondi of uniform size directly into pan containing hot frying oil.
- The frying can be done manually or through a continuous fryer.

Application

- Useful in small scale sweet industry to make sweet boondi, khari (salted boondi) and boondi ladoo.
- Efficient gadget for making boondi at faster rate and great accuracy

- ***Patent filed Application No- 201711039164***

6. LINUS DOMESTIC REFRIGERATOR

Problem identified

- Electrical vapor compression based refrigeration units are cost extensive
- Emission of greenhouse (GH) gases and leakage of refrigerant has adverse effect on the environment



Solution

- Solar energy based farm level/ domestic level refrigeration unit



- No emission of GH gases

Working

- Based on evaporative cooling
- Photo voltaic cell supplies electricity

Application

- Based on evaporative cooling
- Low cost refrigeration for fruits and vegetable
- ***Patent filed Application No- 201711039163***

7. EVACUATED TUBE SOLAR DRYER

Problem identified

- Conventional drying techniques are cost and energy intensive
- Solar energy is available but not optimally used in drying hygienically.



Solution

- Concentric solar drying using evacuated tube
- Comparatively low cost high temperature solar drying

Working

- Solar dryer works on principle of concentrated solar radiations
- Evacuated tubes reduce heat loss by reflected radiations

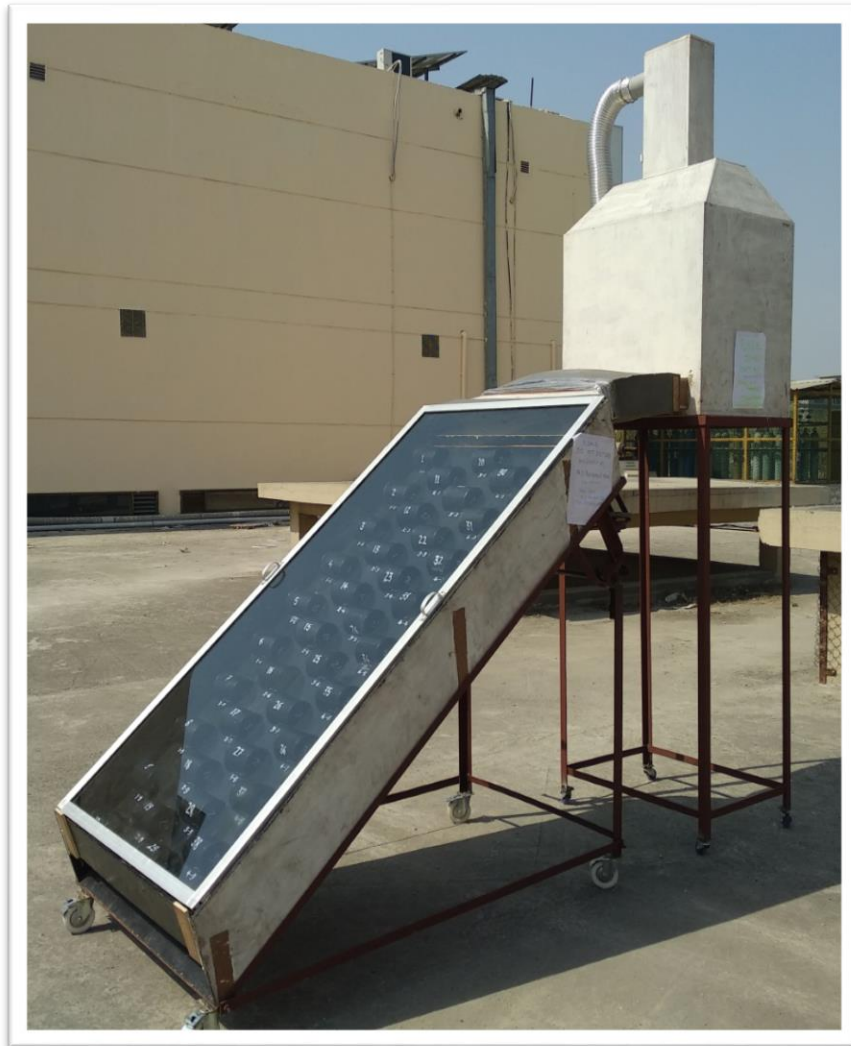
Application

- For high temperature solar drying of fruits and vegetables at faster rate of drying

8. PCM ASSISTED FLAT PLATE COLLECTOR SOLAR DRYER.

Problem identified

- Conventional drying techniques are cost involving
- Solar energy is available but not optimally used in drying hygienically.
- Thermal energy storage is not widely used.



Solution

- Modification in solar drying for extension of drying time using Phase change materials (PCM)



- Low cost solar drying for farm level drying

Working

- Solar dryer works on principle of greenhouse effect
- PCM stores energy for drying in late night hours

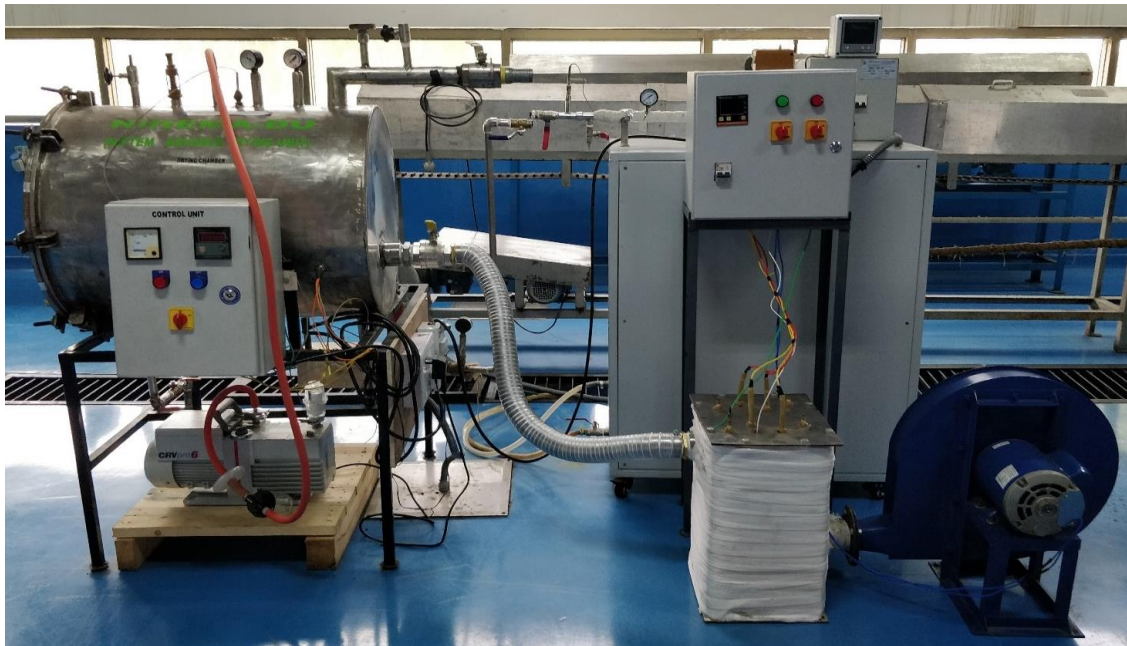
Application

- For low temperature solar drying of fruits and vegetables achieving better quality

9. NIFTEM ADVANCED DRYING UNIT (NIFTEMA-DU).

Problem identified

- Significant wastage in horticultural sector due to post-harvest losses and lack of cold storage facilities in production areas.
- Abundant availability of horticultural crops, preservation of food commodities has been always a challenge.
- Most of the farmers struggle to fetch an optimum price of horticultural crops in peak season due to their abundant availability.
- Increase in demand for dried fruits and vegetables in various capacities like as a dried snack an alternative to fried items, as an ingredient in the bakery, confectionery and dairy industry.
- Dried fruits and vegetables are attracting the attention of industrialist to launch as convenience/ready to eat food as they are in great demand from consumers especially in urban areas.
- Conventional dryers using hot air as the drying medium i.e. hot air drying and vacuum drying suffers from several limitations, such as non-uniform product quality, long drying time, low energy efficiency, unacceptable end qualities.



Solution

- Keeping in consideration advantages and limitation of three drying techniques i.e. Hot air drying, Vacuum drying and Low-pressure super-heated steam drying a multipurpose dryer was developed and fabricated.
- Recommended for farmers and small-scale entrepreneurs who can dry different fruits and vegetables with better retention of quality and reduced post-harvest losses as it will facilitate drying at the farm level.

Working

- Hot air drying - simplest way to dry fruits and vegetables and still, the most commonly used drying technique in developing countries from cost economic point of view.
- Vacuum drying - commonly used for heat-sensitive materials as it provides oxygen-free or oxygen reduced environment.
- Low-pressure super-heated steam drying - a novel drying technique for heat-sensitive food commodities. The superheated steam is used as the drying medium.

Application

- It can be utilized to have better-dried quality produce in different modes of drying, with lower drying time.

10. LOW COST MEAT STORAGE STRUCTURE



Novelty: -

- **First of its kind; fabricated keeping in mind local meat vendors**
- Cost effective/Low cost
- Can solve the problem of huge unorganised meat sector
- Environment friendly, easy to use and affordable
- Doesn't need direct electricity, thus suitable for vendors who does not have electricity
- **Available for technology transfer/commercialization**

- ✓ **A low cost storage system for storage of meat to be sold by local retailers without using direct electricity has been designed and fabricated.**
- ✓ **This storage structure is capable of maintaining a low temperature (4-8°C) and hygienic environment leading to overall improved microbiological quality and safety of meat for consumers**

Application of the equipment:-

- To ensure hygienic, wholesome quality meat for consumers
- Bacterial contamination is reduced owing to keeping meat at chilling temperature
- Meat is protected from flies, insects, dust & other pollutants
- Versatile – can store different types of meat, viz., mutton, veal, chicken, pork
- 3-4 small carcass can be stored at a time (90-110 Kg meat)
- Can be easily assembled/disassembled/transferrable
- Cost: Approx. INR 15000-20000 per Unit

Patent Filed application no. E-2/1351/2018/DEL

11. PROTEIN RICH GRANOLA BAR (Knowhow available for transfer)



Novelty

- ✓ **Low cost high protein bar**
- ✓ **Granola bar developed has 28% protein**
- ✓ **One of the highest protein contents among existing protein/energy bars currently**
- ✓ **Not Available in the market**
- ✓ **Developed after extensive research**
- ✓ **Texture and hardness characterized**
- ✓ **It has 424 Kcal energy, 13% fat, 48.8% carbohydrates, 1.34% ash**
- ✓ **Shelf life: Best before 6 months**
- ✓ ***Recipe available for knowhow transfer***