DEPARTMENT
OF
AGRICULTURAL PROCESS ENGINEERING

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Department (Name & Address)

DEPARTMENT OF AGRICULTURAL PROCESS ENGINEERING,
College of Agricultural Engineering andTechnology,
Dr. BalasahebSawantKonkanKrishiVidyapeeth,
DAPOLI – 415 712
Dist:Ratnagiri (Maharashtra)

About Department

Department of Agricultural Process Engineering, College of Agricultural Engineering and Technology was established in the year 1999 since at the inception ofCAET, at the Headquarters of Dr. BSKKV Dapoli. The department is engaged in Teaching at UG, PG and Doctoral level in the field of Agricultural Process Engineering. Apart from the academic research at UG, PG and Doctoral level, the Department has undertaken some need based research of the agro-horti based commodities to cater the needs of a common man of Konkan region of Maharashtra. The Department also provides the Extension services to the farmers, small scale processors, Self Help Groups in the area of processes and new product development and demonstration of Food Processing Machinery and Equipments. The Department also provides consultancy services and undertakes the testing of different processing machinery for machinery manufacturers.

Academic Programme

The Department of Agricultural Processing has a task of teaching the different subjects pertaining to the area of Crop Process Engineering after the harvest of the crops. The Department undertakes teaching to undergraduate courses and Post-Graduate Courses. UG programmeB.Tech. (Agril. Engg.) has started from the academic year 1999. PG programme of M. Tech. (Agril. Engg.) in APE has stared from the academic year 2004-05. The Department has an intake of two M.Tech.students every year.The Faculty of Agricultural Engineering of Dr. BalasahebSawantKonkanKrishiVidyapeeth, Dapoli is the first faculty in the Maharashtra State to start the Ph.D. degree course from 2008-09. Department has one Ph.D. student intake capacityfor every academic year. New syllabus as per the FOURTH DEANS Committee constituted by ICAR New Delhi for UG has implemented from the year 2006-07 and for PG & PhD programme, it is implemented from 2009-10.

1. **B. Tech. (Agricultural Engineering)**

The details of courses offered in Undergraduate Programmes are as follows:

A. Courses Offered for UG Programme as per New Syllabus (w.e.f. 2006-07)

S.N.	Course No.	Course Title	Credits
1.	APE-121	Thermodynamics	3(2+1)

2.	APE 232	Engineering Properties of Biological Materials and Food Quality	2(1+1)
3.	APE-243	Heat and Mass Transfer	2(1+1)
4.	APE-244	Crop Process Engineering	3(2+1)
5.	APE-355	Dairy and Food Engineering	3(2+1)
6.	APE-356	Drying of Farm Crop	2(1+1)
7.	APE-357	Storage Engineering	2(1+1)
8	APE-368	Refrigeration and Air Conditioning	2(1+1)
		Total	**19(11+8)**

B. Cafeteria Courses Offered during VII Semester for UG Programme as per New Syllabus (w.e.f. 2006-07)

S.N.	Course No.	Course Title	Credits
1.	CAF-APE-471	Food Packaging Technology	3(2+1)
2.	CAF-APE-472	Development Of Process Products and Equipments	3(2+1)
3.	CAF-APE-473	Food Processing Plant Design and Layout	3(2+1)
4.	CAF-APE-474	Rice Process Engineering (New Proposed)	3(2+1)
5.	CAF-APE-475	Seed Process Engineering (New Proposed)	3(2+1)
6.	CAF-APE-476	Process Engineering Of Horticultural Crop (New Proposed)	3(2+1)
7.	CAF-APE-477	Advances In Food Process Engineering (New Proposed)	3(2+1)
8	CAF-APE-478	Process Engineering Of Animal Products (New Proposed)	3(2+1)
9	CAF-APE-479	Bio Process Engineering (New Proposed)	3(2+1)
10	CAF-APE-4710	Food Safety, Standards And Laws (New Proposed)	3(2+1)
11	CAF-APE-4711*	Baking Technology	3(2+1)
		Total	**33(22+11)**

2. M. Tech (Processing and Food Engineering)

Courses offered in Postgraduate Programmes are as follows:

A) Major Subjects (Min. 20 Credits)

Sr. No.	Course No.	Course Title	Credits
1	PFE 501*	Transport Phenomena in Food Processing	3(2+1)
2	PFE 502*	Engineering Properties of Food Materials	3(2+1)

3	PFE 503*	Advanced Food Process Engineering	3(2+1)
4	PFE 504*	Unit Operations in Food Process Engineering	2(1+1)
5	PFE 506	Processing of Cereals	2(1+1)
6	PFE 508	Fruits and Vegetables Process Engineering	3(2+1)
7	PFE 511	Food Quality and Safety Engineering	3(2+1)
8	PFE 513	Storage Engineering and Handling of Agricultural Products	2(1+1)
9	PFE 519	Processing of Pulses and Oilseeds	2(1+1)
10	PFE 509	Meat Processing	3(2+1)
11	PFE 516	Design of Bins and Silos	2(2+0)
12	PFE 518	Food Plant Design and Layout	2(1+1)
13	PFE 592*	Special Problem	1(0+1)
14	PFE 595#	Industry/Institute Training	NC

* - Compulsory,

- Minimum Three Weeks Training

B) Minor Subjects (Min. 9 Credits)

No.	Course No.	Course Title	Credits
1	PFE 507	Food Process and Material Handling Equipment Design	3(2+1)
2	PFE 510	Food Packaging	3(2+1)
3	PFE 512	Farm Structures and Environmental Control	2(2+0)
4	PFE 514	Seed Drying, Processing and Storage	3(2+1)
5	PFE 515	Biochemical and Process Engineering	3(2+1)
6	RES 506	Design and Analysis of Renewable Energy Conversion Systems	3(3+0)
7	RES 507	Agricultural Waste and By-Products Utilization	3(2+1)
8	RES 521	Energy Management in Food Processing Industries	3(1+2)
9	FMPE 510	Ergonomics and Safety in Farm Operations	3(2+1)

C) Supporting Subjects (Min. 5 Credits)

No.	Course No.	Course Title	Credits
1	STAT 501	Statistical Methods	3(2+1)
2	MATH 502	Methods of Numerical Analysis	2(1+1)
3	FMPE 505	Instrumentation Stress Analysis	3(2+1)
4	AE 502	Simulation and Modeling	3(3+0)
5	FMPE 521	Computer Aided System Design	2(0+2)
6	PFE 520	Applied Food Chemistry	2(1+1)
7	PFE 521	Applied Food Microbiology	2(1+1)

3. Ph.D. (Processing and Food Engineering)

Courses offered in Doctoral Studies are as follows:

Sr. No.	Course No.	Course Title	Credits
1	PFE 601*	Textural& Rheological Characteristics of Food Materials	3(2+1)
2	PFE 602 *	Advances in Food Processing	3(3+0)
3	PFE 603	Mathematical Models in Food Processing	2(2+0)
4	PFE 604	Advances in Drying of Food Materials	3(2+1)
5	PFE 605	Waste and By –Products Utilization	3(2+1)
6	PFE 606	Food Quality Systems & Management	3(2+1)
7	PFE 607	Nutraceuticals and Health Foods	3(2+1)
8	PFE 608	Enzymes in Food Processing	3(2+1)
9	PFE 609	Plant Utilities and Plant Safety	3(2+1)

* Compulsory Courses

B) Minor Subjects (Min. 8 Credits)

Sr. No.	Course No.	Course Title	Credits
1	PFE 610	Techniques in Food Analysis	3(1+2)
2	PFE 611	Bakery and Confectionary Technology	3(2+1)
3	PFE 612	Sensory Evaluation	2(1+1)
4	PFE 613	Automation in Food Processing	3(2+1)
5	PFE 614	Cold Chain Management	2(2+0)
6	PFE 615	Food Supply Chain Management	2(1+1)
7	PFE 617	Environmental Engineering	3(2+1)
8	PFE 618	Solid-Fluid Operations	2(1+1)
9	RES 605	Fuels and Combustion	2(1+1)
10	RES 623	Energy Management & Planning	3(2+1)

C) Supporting Subjects (Min. 5 Credits)

Sr. No.	Course No.	Course Title	Credits
1	PFE 620	Computer Applications in Food Industry	3(1+2)
2	PFE 621	Current Topics in Food Processing	2(2+0)
3	STAT 531	Computational Methods in Engineering	3(2+1)
4	STAT 601	Operation Research	3(2+1
5	STAT 612	Regression Analysis	3(2+1)
6	MATH 601	Mathematical Modelling and Software Applications	3(2+1)
7	MATH 602	Optimization Techniques	2(1+1)

8	AE 605	Project Planning and Implementation	3(2+1)

D)Non-credit Compulsory Courses for Master/Doctoral programme in all disciplines / Optional for Ph.D. Scholars)

Sr. No.	Course No.	Course Title	Credits
1	PGS 501	Library and Information Services	0+1
2	PGS 502	Technical Writing and Communications Skills	0+1
3	PGS 503 (e - course)	Intellectual Property and its Management in Agriculture	1+0
4	PGS 504	Basic Concepts in Laboratory Techniques	0+1
5	PGS 505 (e - course)	Agricultural Research, Research Ethics and Rural Development Programmes	1+0
6	PGS 506 (e - course)	Disaster Management	1+0

4. Experiential Learning Modules

- **Bakery Experiential Learning (Training) Modules**

Bakery Experiential Learning Unit at establised through ICARat DBSKKV Dapoli

Visit of Hon. DG ICAR New Delhi to Bakery Experiential Learning Unit

Products developed at Bakery Experiential Learning Unit DBSKKV Dapoli (Visit of Dr Patil Hon VC UAS Banglore)

Students Trained in Bakery Experiential Learning Unit DBSKKV Dapoli

Practicals by Students in Bakery Experiential Learning Unit DBSKKV Dapoli

4.1. **Facilities Created in Bakery Unit**

Laboratory/Equipment/Machinery

Sr. No.	Equipment name	Quantity
1.	Convection oven	01
2.	Deck oven	01
3.	Bun Divider	01
4.	Proofer	01
5.	Shifter Vibratory type	01
6.	Generator Set 25 KVA (Kirloskar make)	01
7.	Spiral Mixer (SP - 20)	01
8.	Planetary Mixer, 5 lit	01
9.	Planetary Mixer, 20 lit	01
10.	Rotary Moulder	01
11.	Bread Slicer	01
12.	Table Top Slicer	01
13.	Water Tank	02
14.	Sealing Machine	01
15.	Weighting balance, 10 kg	01
16.	Weighting balance, 150 kg	01
17.	Gas Connection and Cylinder Bank	01
18.	Office Furniture	01
19.	Refrigerator	01
20.	LCD Projector	01
21.	Laptop	01
22.	Bread Cooling Rack	01
23.	Trolley Rack Type	01
24.	Packaging Table	01
25.	Sugar Grinder	01
26.	Gas Pipe Duct	01
27.	Biscuit Trays	01
28.	Mold	285
29.	Tray	20
30.	Working Table	01
31.	Dough Sheeter	01
32.	Rotary Rack Oven	01
33.	Display Counter	02

	
Planetary Mixture	**Rotary Rack Oven**
	
Bun Divider	**Deck Oven**
Bakery Machineries at DBSKKV Dapoli	

Moulder

Deck Oven

Sheeter

4.2 **Infrastructure strengthening -** The details of infrastructure created for bakery unit are as follows:

Sr. No	Title	Size
1	Free space in front of bakery unit	20.5 X 26.5
2	Outer Dimension Bakery Unit	19.50 X 16.50 19.50 X 16.50 X 2.89
3	Office Room	3.48 X 2.74 3.48 X 2.74 X 2.43
4	Sale Room	4.57 X 3.65 4.57 X 3.65 X 2.89
5	Class Room	3.65 X 8.99 3.65 X 8.99 X 2.89
6	Entry space	3.90 X 1.61 3.90 X 1.61 X 2.89
7	Store Room	3.10 X 3.38 3.10 X 3.38 X 2.89
8	Working Room	19.50 X 16.50 19.50 X 16.50 X 7.77

4.3 Impact of Bakery Unit at DR BSKKV Dapoli

i)	**Products developed**	A. **Biscuits**– 1) Anmol Biscuit with pure AMUL butter, 2) Finger millet Biscuit, 3) Nankatai, 4)

		TilMakaroom, 5) Bhumika Biscuit (Bajara, Sorghum) 6) Harsh Biscuit (Bajara, Sorghum, Soyabean), 7) Dryfruit Biscuit 8) Wheat Biscuit B. **Khari** – 9) Jira Khari, 10) Twist Khari, 11) Soft Khari, 12) Plain Khari, 13) Masala Khari 14) Samosa Khari C. **Butter** – 15) Khara Butter (Namkin), 16) Jira Butter 17) Maska Butter D. **Toast** – 18) Kaju Toast, 19) Chocklate Toast 20) Amul Toast E. **Cakes** (various types) **F. Breads** (various types) **G. Baked Patis** (Veg Patisand Egg Patis) etc.
ii)	**Products Marketed**	Counter sale
iii)	**Total Revenue generated**	–
iv)	**Students trained (year wise)/total**	About 30 Students every year
vi)	**Alternate use of facilities created**	• The facilitiesis used to provide training to members of Self Help Groups / young entrepreneurs, Small Scale Food Processors etc. • Provided three trainings to 45 participants on Processing of Bakery products in Bakery. • These developed facilities are also used for Research and Development activities of the Department of Agril. Process Engineering.

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❖ CASHEW PROCESSING TRAINING CENTER
PHT for Cashew Entrepreneurs (HOT – Cashew)

Cashew Processing Training Centre (Experiential Learning Unit) at DBSKKV Dapoli

Inauguration of Cashew Processing Training Centre (HOT) at DBSKKV Dapoli in presence of Dr. G. C. Tewari, ADG (EPD) ICAR, New Delhi

Students and staff of the module of Processing of Cashew Experiential Learning Module (Training of 25 credits) at DBSKKV Dapoli

Discussion with Trainees(Dr. N. J. Thakor, HOD, AgrilProcess Engineering, Dr BSKKV Dapoli.

2. Amount Sanctioned: **Rs. 8.00 lakh**

3. Amount utilized: **Rs. 7.00 lakh**

(Rs. in Lakhs)

Subject	Works	Equipment	Recurring contingency	Total
Experiential Learning Unit	5.00	2.00	.0.00	7.00

4. Facilities Created

i)	**Laboratory/equipment/machinery**	

Sr. No.	Equipment name	Quantity
1.	Cashew Nut Boiler (60 kg)	01
2.	Cashew Nut Sheller with cutting Table	01
3.	Cashew Nut Dryer (60 kg)	01
4.	Grading tables (SS top)	01
5.	Multipurpose Pulper	01
6.	Screw Juice Extractor	01
7.	Basket Press	01
8.	Big Stainless Steel Bowl with lid (25 kg), Knives	01 set
9.	Food Processor	01
10.	Microwave Oven (Godrej make -23 lit)	01
11.	Refractometer (30-60 ^{O}Brix) and (60-90 ^{O}Brix)	02
12.	Electronic Weighing Balance 3 kg capacity and 30 kg Capacity each one.	02
13.	Autoclave	01
14.	Hand Operated Sealing machine 1.6 m/50 mm and 1.0 m/30 mm	02
15.	Printing Machine	01

ii)	**Infrastructure strengthening**	The details of infrastructure created for bakery unit are as follows:

Sr. No	Title	Size (m)
1	Free space in front of cashew unit	12.50 X 7.50
2	Outer Dimension Cashew Unit	12.50 X 9.10
3	Office Room	3.90 X 3.10

4	Boiler shed	5 X 3.5
5	Open Drying shade	5 X 3.5
6	Processing Area	10.0 x 6.25

5. Impact

i)	**Products developed**	**Cashew nuts (various grades)**
ii)	**Products Marketed**	Counter sale
iii)	**Total Revenue generated**	_
iv)	**Students trained (year wise)/total**	
vi)	**Alternate use of facilities created**	• The facilitiesis used to provide training to members of Self Help Groups / young entrepreneurs, Small Scale Food Processors etc. • Provided trainings to 55 participants on Processing of Cashew nuts to farmers & Processors. • These developed facilities are also used for Research and Development activities of the Department of Agril. Process Engineering.

5. Infrastructures Facilities (Laboratories)

A) Laboratories:

1. Thermodynamic & Refrigeration Laboratory
2. Grain Processing Laboratory
3. Crop Processing Laboratory
4. Fruits Processing Laboratory (NAIP Funded)
   (A value chain for Kokum, Karonda, Jamun& Jackfruit)
5. Extrusion Cooking Unit (MoFPI Funded)
6. Coir Processing Unit
7. Coconut Processing Unit (CDB Funded)
8. GIC Silo Unit

B. Important instruments/facilities in Laboratories

1. Emissivity Measurement Apparatus
2. Natural Convection Apparatus
3. Heat Transfer in Agitated vessel
5. Stefan Boltzman Apparatus
6. Parallel flow & counter flow 5. heat exchanger
7. Shell & Tube heat exchanger
8. Thermal conductivity of metal rod

9. Forced convection apparatus
10. Thermal conductivity of guarded hot plate method
11. Composite Wall Apparatus
12. Infra-red Moisture Meter
13. Indosaw Hand Test Sieves, Model-6729
14. Indosaw Seed Blower-6719
15. Indosaw Rice Testing Mill, Model-6704
16. Indosaw Rice Miller-6702 (Mc-Gill Type)
17. Indosaw Rice Sizing Device, Model-6701
18. Mobile Seed Processing Unit
19. Seed Grain Polisher, Cap.2 to 2.5 TPH
20. Centrifuge Machine
21. Anemometer, 0-10000 rpm digital
22. Butryo Hand Refractrometer
23. Tray Type Dryer
24. Hot Air Oven
25. Cashew Apple Juicer with table top and ice box
26. Muffle Furnace Lab model Rectangular (0-1200°C)
27. Autoclave Electrical model made of brass (Gun metal)
28. Desiccators cabinet thick Aluminum sheet
29. Roller Conveyor (Lab Model)
30. Batch type seed/grain dryer
31. Deep Freeze, (268 litrs.) Double walled.
32. Spiral Separator, Capacity-100 Kg
33. Destoner Positive Pressure type lab model, Capacity-1 TPH
34. Cashew Nuts Dryer, Capacity-12 Trays
35. Cashew Boiler, 30 kg capacity
36. Cashew Cutter
37. Basket Press Juice Extractor,Size - 60 mm X 30 mm
38. Cold Storage Plant Tutor
39. Air Conditioner Tutor (Vapour, Compression and Absorption)
40. Freeze dryer Standard Laboratory Model with 1 ton compressor, 220-230 V,single phase, 50Hz A.C. supply, 3lit capacity
41. Lab Model for Compressor Refrigeration Unit cut section working model ofgear type
42. Digital Lux Meter
43. Hygrometer Barigo German
44. Hair Hygrometer
45. Vernier caliper Mitutoyo made
46. Digital Vernier caliper Mitutoyo made
47. Digital MultimeterDC 200 mv/2/20/200/1000VAccuracy + 0.5%,

48. Pulper Machine, MSW-611DAIRY UDYOG
49. Cream separator, 60 lit/hr, Speed 45/50 rpmDAIRY UDYOG Butter churner (Lab. Scale capacity)
50. AMBIKA Khoa making machine
51. Grader cum Polisher with 1 hp motor
52. Mini Ice Cream Plant
53. Navdeep 5 kg fully Alarm Gharghanti (Floor mill)
54. TEKNIK SEED GRADER (PADDY CLEANER), Size 80 x 54 x 75 cm
55. Vegetable Preservator, 5 kg capacity with three plastic basket each
56. Seed Analysis kit
57. Seed Counter
58. Mastect DT – 615 Hygro Thermometer
59. Max / Min Hygrothermometer
60. Non Contact Thermometer, Laser 20-500 °C1000 A AC clamp meter with temperature and frequency
61. TRH- 401 Humidity temperature indicator controller Humidity range 0 to 100% & Temperature range – 40 to 120 °C (LED display)
62. TNAU Stored insect Management Kit
63. GI Grain storage Bin, 40- 50 Kg
64. TC-303 Programmable Temperature Controller
65. Erma Hand Sugar Refractometer
66. Laboratory Aspirator (Bates Type)
67. Brook Field Programmable ViscometerRange-15 cPs, Max. Range- 6mPas
68. Aonla Candy Cutting Machine
69. Spray Dryer, Cap.- 1 lit/hr
70. Texture Analyzer, Model QTS- 50,
71. Brookfield Make Load Range – 50 Kg,
72. Juice Vending Machine, Cap.-17 lit.
73. Air Screen Seed Grader, with additional Indent segment and top screen set andbottom screen sets.
74. Tray Wrapping machine, Model- THM-450
75. Vertical Deep FreezerSize: 5’ x 3’ x 2’Door : 5 (Five)Outer Body Stainless Steel
76. Grill Microwave OvenMake-LG, Capacity –19 Lit.
77. Twin Screw Extruder
    a. Standalone panel board with push button station
    b. Laboratory model ribbon blender with stainless steel contact port with doublehelical ribbon
78. Digital Anemometer *LUTRON TWAIWAN* Make (Range:0.4 to 30 m/s)

Important Equipments/Facilities in Fruit Processing Laboratory (NAIP Funded)

1. Head Space Analyser

2. Chiller (1.5 TR)
3. C A Storage (1000 L)
4. Vaccum Dryer
5. Drum Dryer
6. Hot Air Oven
7. Hot water Generator
8. Form Fuill Seal Machine
9. Fruit Washer
10. Rotary Bottle Wahsing Machine
11. Lebelling& Printing machine
12. Vacuum Packaging Machine
13. Washing Tank
14. Digital Bomb Calorimeter
15. Pulversier
16. Image Processing System
17. Microwave Drying System
18. Centrifugal Separator
19. Vacuum Dryer
20. Water Distilation Unit
21. Digital Water Bath
22. pH meter
23. Spectrophotometer
24. JamunPulper- Capacity 300 kg/hr
25. Kokum Cutting Device- Capacity - 500 kg p. Hr
26. Jackfruit cutting device - Capacity - 15kg / hr.
27. Kokum Rind Shredder Size
28. Fermenter
29. Jackfruit Frying Device
30. Fruit Firmness Tester

d) Photographs of Equipment's/ Machineries

pH Meter

Texture Analyzer

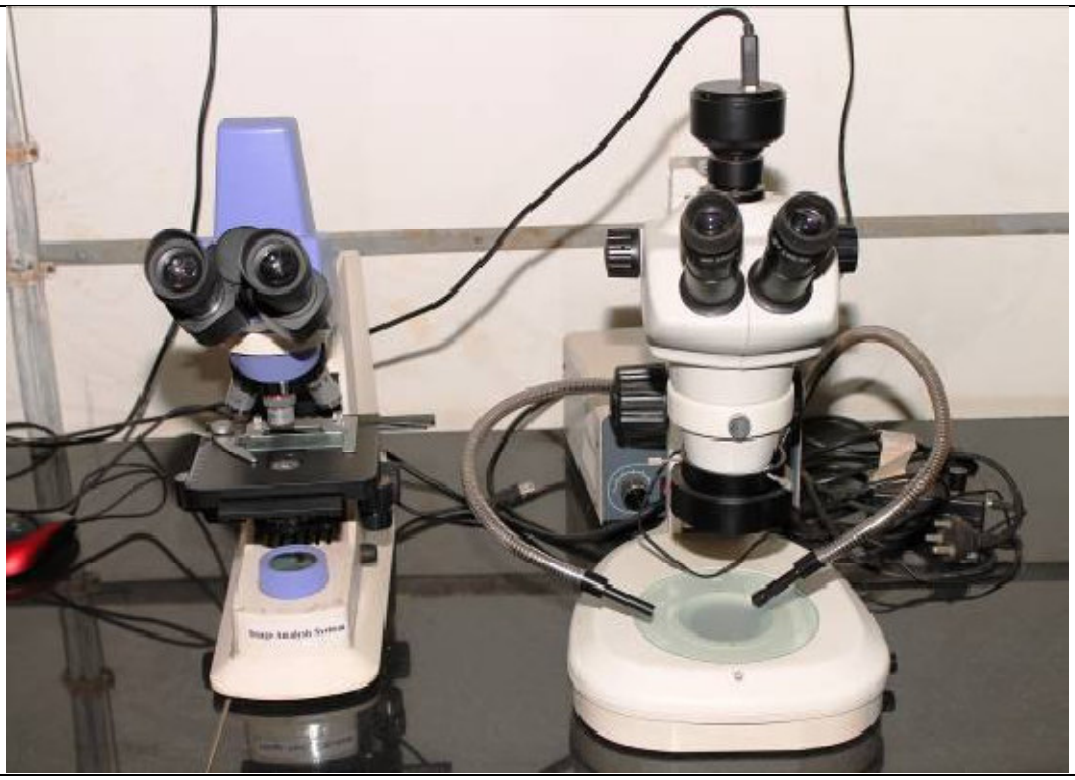


Image Analysis System

Spectrophotometer

Twin Screw Extrusion Machine

Form Fill Machine

Microwave Vacuum Dryer

Digital Bomb Calorimeter

Spray Dryer

Hunterlab Colorimeter

Research Activities and Achievements

Department of Agricultural Process Engineering,
College of Agril. Engg. & Tech., Dapoli.

1. Academic Research

❖ Undergraduate (B. Tech.) Projects

List of UG Research- B.Tech. (Agril. Engg.)

Sr. No.	Project Report Title	Year	Students	Advisor/s
1	Design and construction of storage structure for paddy grains	2002-03	Mr. Bansode V. J. Mr. Idate S. S. & Mr. Padhye S. J.	Er. Khandetod Y. P. &Er. Sonawane S. P.
2	Performance Evaluation of different paddy threshers	2002-03	Mr. Chiplunkar V. V. Mr. Patil B. S.	Er. Sonawane S. P.
3	Study and performance Evaluation of mobile seed processing unit	2002-03	Mr. Dunge V. S. Miss. Mhadgnt S. A.	Er. Khandetod Y. P.
4	Standardization of processing parameter in steam Roasting of Cashew nut	2002-03	Mr. Dandekar S. R. Ms. Salvi D. A.	Er. Jain S. K. & Er. Kad V.P.
5	Standardization of Cashew processing parameters and performance evaluation of cashew nut processing machineries.	2003-04	Mr. Alwani M. P. Mr. Thakur P. R.	Er. Khandetod Y. P &Er. Kad V. P.
6	Value addition in finger millet	2003-04	Miss. Patil J. P. Miss. Lawande N. S.	Er. Sonawane S. P.
7	Study of engineering properties and drying characteristics of nutmeg	2003-04	Mr. Gaykar S. D. Miss. Mahadalekar K. V.	Er. Sonawane S. P
8	Standardization of process Technology for Ragi malt Biscuits	2004-05	Mr. Patil P. N. Miss. Bhingardive A. R.	Er. Sonawane S. P
9	Performance evaluation of different methods of CNSL Extraction.	2004-05	Mr. Aswani Raina Mr. Kulkarni N. N.	Er. Sawant A. A.
10	Standardization of cashew nut processing parameter	2004-05	Miss. Holmukhe H. U. Miss. Prabhudesai R. D.	Er. Kad V. P.
11	Processing of Kokum for powder and Jam	2005-06	Mr. Patil G. K. Mr. M. D. Alam	Er. Sawant A. A.
12	Comparative study of freeze drying and hot air drying of carrots	2005-06	Mr. Sane G. A. Mr. Bharade P. S.	Er. Sanawane S. P.
13	Comparative drying study of mechanical dryer using paddy	2005-06	Mr. ManJrekar S. S. Mr. Khaire V. L.	Er. Kad V. P.
14	Performance evaluation of	2006-07	Mr. Dhond S. M.	Dr. N. J Thakur

Sr. No.	Project Report Title	Year	Students	Advisor/s
	commercial rice mills in Rohatahsil		Mr. Tambada N. V.	
15	Design and fabrication of thermal conductivity apparatus for cashew nut	2006-07	Mr. Kamble R. L. Mr. Shinde V. T.	ER. Sonawane S. P.
16	Study of effect of pine apple blending on the making of kokum jam	2006-07	Mr. Bhosale N. R. Miss. Singh S. S.	Er. Kad V. P.
17	Study on osmotic dehydration of pineapple	2007-08	Miss. Jalgaokar K. R. Miss. Naik N. R.	Dr. N. J. Thakur
18	Dehydration of Fenu Greek. (Methi)	2007-08	Miss. Jadhav D. V. Miss. More P. P.	Er. Sawant A. A.
19	Study of process parameters for drying of milk by spray dryer.	2007-08	Shri. Kadam S.S. Shri. Dixit G. B.	Dr. N. J. Thakur
20	Effect of baking temperature and oil content on Quality of finger millet flour biscuits.	2008-09	Shri. Shinde U. N.	Dr. S. B. Swami
21	Survey study of processing of horse grain in DapoliTahasil	2008-09	Sonavane A. V. Mr. Dhok S. M.	Er. Sawant A. A.
22	Study of effect of different packaging material in quality of coconut chips	2008-09	Mr. Raut H. N. Mr. Thombare J. J.	ER. S. P. Divekar
23	Soaking and malting of finger millet grains	2009-10	Shri. Gurav H. S.	Dr. S. B. Swami
24	Roasting study on horse gram (Kulith)	2009-10	Mr. Bhoye A. S. Mr. Bhoye N. S.	Er. Sawant A. A.
25	Study of drying of nutmeg	2009-10	Mr. Mulla H. Y. Mr. Sawant M. V.	ER. S. P. Divekar
26	Effect of temperature on viscosity of food products (Kokum, cashew apple, mango pulp and Karonda syrup)	2009-10	Ms. Wagh S. S.	Dr. S. B. Swami
27	Testing of Cashew Dryer	2009-10	Mr. Patil R. J.	Er. Sawant A. A.
28	Influence of packaging materials on hardness of cashew kernel	2009-10	Mr. Pitre A. M.	ER. S. P. Divekar
29	Measurement of total soluble solids (TSS) of different mango food products by digital handheld Refractometer at different temperatures	2009-10	Miss. Pendse K. P.	Dr. N. J. Thakor

Sr. No.	Project Report Title	Year	Students	Advisor/s
30	Roasting studies of horse gram (macrotylomaUniflorum)	2011-12	Ms. Chavan S. V.	Er. Sawant A. A.
31	Calorific studies of different fruit powders	2011-12	Ms. Desai S. S.	Dr. S. B. Swami
32	Dehydration of Math (Amaranthesscruentus) by different drying methods	2011-12	Ms. Powale M. S.	Dr. N. J. Thakor
33	Combustion study of locally available biomass	2011-12	Mr. Rathod K. S.	Er. S. P. Kurhekar
34	Mechanical properties of cashew nut under compression loading at different moisture content.	2012	MsGawaiAsmitaMilind	Dr. S. B. Swami
35	Effect of yeast Concentration quality 2012 Baking temperature on quality of slice bread.	2012	Mr. P.R. Murudkar	Dr. S. B. Swami
36	Studies on the properties of Kokum oil (Butter)	2012	Ms. S.A. Navale	Dr. S. B. Swami
37	Physical Properties of cashew nuts quality cashew kernels	2012	Ms. J. S.Raut	Dr . N. J. Thakor
38	Study of chemical properties of cashew 2012 Nut tester	2012	Mr. G. N.Dhale	A. A .Sawant
39	Moisture dependant physical properties of 2012 horse gram	2012	Mr. P.G. Ambekar	Dr. N. J. Thakor
40	Development of extruded product from Horse gram based composite flour	2012	Mr. A.M. Kondekar	A. A. Sawant
41	Study of Dehulling of Charoli	2013	Ms. P. A. Desai	A. A. Sawant
42	Development of dehydrated ripe Jackfruit bulbs based cupcake	2013	Mr. S. S. Kadam	Dr. N. J. Thakor
43	Measurement of Calorific Values of DBSKKV, developed different baked products	2013	Ms. C. R. Kavitkar	Dr. N. J. Thakor
44	Measurement of viscosity of different baked products	2013	Ms. G. K. Lad	Dr. N. J. Thakor
45	Study of Kokum Rind Powder Extract	2013	Ms. J. N. Solanki	Dr. S. B. Swami
46	Preservation of Snow Ball Tender Coconut	2014	Mr. D. G. Jadhav and Mr. P.P. Bavkar	Dr. S. B. Swami
47	Development of Egg Free	2014	Ms. GarimaKhardwal and	Dr. S. B. Swami

Sr. No.	Project Report Title	Year	Students	Advisor/s
	Mixes Using Jackfruit Seed Starch		Ms. P.P. Yerunkar	
48	Engineering Properties of Cashew Nut and Kernel	2014	Mr. Patil M. S. Mr. Shet D. H.	Dr. S. P. Sonawane
49	Engineering Properties of DBSKKV Developed Biscuits	2014	Ms. H.A. Patil Ms. N. G. Munj	Er. S. B. Kalse
50	Study of Physico-chemical Properties of Pineapple & Development of Pineapple Peeler	2015	Mr. N.S. Bhore& Mr. S.A. Surwade	Dr. S. B. Swami
51	Performance Testing of CAET Developed Cashew Nut Grader	2015	Ms. V.V. Chavan& Ms. R.S. Patil	Dr. S. P. Sonawane
52	Development of Powder from Sapota	2015	Mr. R.M. Patel & Ms. S.S. Karmarkar	Dr. N. J. Thakor
53	Preparation of Biscuits using Jamun Seed Powder.	2015	Ms. K.R. Samant& Mr. S.S. Salvi	Er. S. B. Kalse
54.	Studies on Engineering Properties of Mango Stone	2015	Mr. A. K. Shahnee& Mr. Kailash Patel	Dr. S. P. Divekar

❖ Post Graduate (M.Tech.) Projects

List of PG Research- M..Tech. (Agril. Process Engg.)

Sr. No.	Project Report Title	Year	Students	Advisor/s
1	Design, Development and Performance Evaluation of Copra Dryer.	2005-06	Miss. S.A. Sane	Dr. N. J.Thakor
2	Performance Evaluation of GIC silos for Wheat against CAP and Godown storage	2005-06	Miss. V.K. Sonavane	Dr. S. P. Sonawane
3	Storage Behaviour of Wheat in Long Term Storage in GIC Silo, CAP and Godown methods.	2006-07	Mr. S.D. Javeer	Dr. S.P. Sonawane
4	Testing & Development of CAET, Dapoli Developed Copra Dryer using Coconut Husk as a fuel	2008-09	Miss. S.K. Sawant	Dr. N. J. Thakor
5	Storage Changes of Paddy in	2009-10	Mr. A. N. Deshbhratar	Dr. N. J. Thakor

Sr. No.	Project Report Title	Year	Students	Advisor/s
	GIC silo & Bag Storage under Konkan climatic conditions,			
6	Long term Storage changes of Paddy in GIC silo & Bag Storage under Konkan climate conditions.	2010-11	Mr. S. C. Patil	Dr. N. J. Thakor
7	Preservation Studies of Jackfruit bulbw (artocarpusheterophyllusL.) by Different Processing Techniques	2011-12	Mr. H. D. Rupanawar	Dr. N. J. Thakor
8	Organoleptic Studies of Tender Cashew Kernel and Mature Soaked Cashew Kernel.	2011-12	Miss. M. D. Katkar	Dr. N. J. Thakor
9.	Development of Extruded Product from Finger Millet based Composite Flour	2012-13	Miss A.D. Divate	Dr. N. J. Thakor
10.	Influences of Extrusion Processing Parameters on Finger Millet based Extrudates Products.	2013-14	Mr. M. M. Mali	Dr. N. J. Thakor
11.	Preservation of Kokum Rind by Different Drying Methods	2013-14	Ms. A. R. Hande	Dr. S. B. Swami
12.	Development of Jackfruit Seed Flour by Different methods	2014-15	Miss P.S. Deshmukh	Dr. S. B. Swami
13.	Development of Arrowroot-Lesser yam – Potato based Extruded Products	2015-16	Miss S. A. Navale	Dr. S. B. Swami
14.	Dehydration Studies of Cashew Apple	2015-16	Mr. M.N. Tembhare	Dr. S.P. Sonawane

Ongoing M.Tech. Projects - 02

❖ Doctoral(PhD) Projects

List of Doctoral (Ph.D.) Research Thesis Submitted

Sr. No.	Project Report Title	Year	Students	Advisor/s
1	Studies of Extraction of Cashew Nut Shell Liquid.	2012-13	Mr. A.P. Chaudhari	Dr. N. J.Thakor

Ongoing Ph.D. Projects - 03

2. Research Recommendations

The following recommendation were passed in various JOINT AGRESCO MEETINGS (state level) by the Department of APE, CAET Dapoli

1	**:**	Steaming of Cashew Nut using vertical boiler (direct type provided with pressure gauge and safety valve) with steam pressure of 25 psi for 15 min duration is recommended for easy shelling of cashew nuts, maximum whole kernel recovery and acceptable colour.

		Year - 2006
2	**:**	It is recommended to make finger millet biscuits of high energy value and good acceptability to the consumers finger millet malt, rawa (semolina) and maida (refined wheat flour) in proportion of 70:15:15
		Year - 2009
		
3	**:**	Sawdust fired indirect heated dryer developed by Dr. BalasahebSawantKonkanKrishiVidyapeeth, Dapoli is recommended for drying of arecanut
	:	**Year - 2010**
		
4	**:**	Dr. BalashebSawantKonkanKrishiVidyapeeth developed process of drying of Tender cashew (green Cashew) using microwave vacuum dryer at 25 s on-30s off time of magnetron for 50 minutes or using Tray dryer at 30^0C for 19.25 hours and kept in glass bottle at refrigerated condition is recommended for preservation of Tender Cashew (green Cashew) kernels for 12 months.
		(Year - 2012)

			
5	**:**	Dr. BalashebSawantKonkanKrishiVidyapeeth developed process of drying of Ripe Jackfruit bulbs without seed using microwave vacuum dryer at 25 s on-30s off time of magnetron for 2.17 hours or using Tray dryer at 60^0C for 101 hours can be stored in good condition in polyethylene pouch upto six months is recommended for better colour, hardness and acceptability of dried Jackfruit bulbs.	
		(Year –2012)	
			

6	**:**	Dr. BalashebSawantKonkanKrishiVidyapeeth developed process for drying of kokum rind obtained from cleaned and graded ripe kokum fruits at 65^0C in tray dryer for 12 hours is recommended for making kokum rind powder
		(Year –2012)

		
7	**:**	The process for making of kulith flour (Horse gram) developed by Dr. BalasahebSawantKonkanKrishiVidyapeeth is recommended.
	:	**(Year –2013)**
		
8	**:**	The process for dehulling of kokum seed developed by Dr. BalasahebSawantKonkanKrishiVidyapeeth is recommended.
		(Year - 2013)

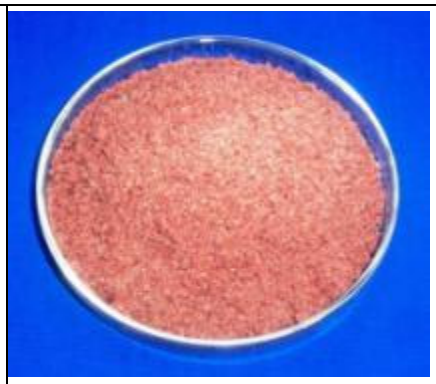
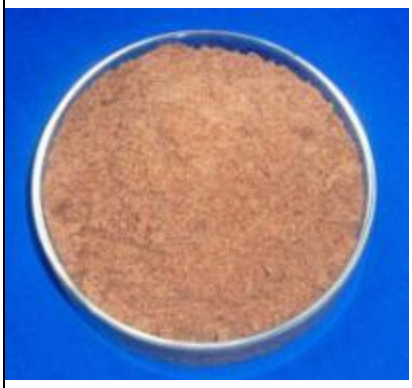
9	**:**	The process for baking of Finger millet based muffins rich in calcium, iron and fibre prepared from flour of 20% finger millet and 80% maida, mixed by planetary mixer at 240 rpm speed and baked at 190^0C for 20 min developed by Dr. BalasahebSawantKonkanKrishiVidyapeeth is recommended.

	:	**(Year –2013)**
		
10	:	The process for drying of Kokum rind using tray dryer at 60^0C up to 20 h or in solar dryer up to 31 h and packed in plastic boxes and stored at room temperature is recommended for preservation of kokum rind up to 6 months for better retention of acidity, red colour and calorific value developed by Dr. BalasahebSawantKonkanKrishiVidyapeeth.
		(Year –2013)
		

11	:	The process developed by Dr. BalasahebSawantKonkanKrishiVidyapeeth for preparation of *Kokum Agal,* packed in glass bottle and stored upto 12 months, is recommended.
		(Year –2013)

		
12	**:**	The process developed by Dr. BalasahebSawantKonkanKrishiVidyapeeth for preparation of Kokum ansul, packed boxed and stored upto 12 months, is recommended.
		(Year –2013)
		

13	**:**	The process developed by Dr. BalasahebSawantKonkanKrishiVidyapeeth for making of Kokum Sarbat packed in Met Pet Polypack and stored upto 9 months, is recommended.
		(Year –2013)

			
14	**:**	The process developed by Dr. BalasahebSawantKonkanKrishiVidyapeeth for making of Kokum Solkadhi Mixes Packed in Met Pet Polypack and stored upto 9 months, is recommended.	
		(Year –2013)	
			

15	**:**	The process to extract good oil from kokum seed by steaming it at the 10% (db) m.e. for 20 min using screw press, developed by Dr. BalasahebSawantKonkanKrishiVidyapeeth is recommended. Extracted oil

		(butter) can be preserved in good condition by packing the oil in rigid plastic container and storing at refrigerated condition.
		(Year –2013)
		
16	**:**	The process developed by Dr. BalasahebSawantKonkanKrishiVidyapeeth for Osmo-Tray drying of ripe jackfruit bulbs, packed in met pet poly pack and stored upto 9 month is recommended.
		(Year –2013)
		

17	**:**	The process developed by Dr. BalasahebSawantKonkanKrishiVidyapeeth for making Jackfruit bulbs powder, packed in Met pet polypack and stored up to 12 months, is recommended.
		(Year –2013)

		 
18	**:**	Finger Millet based Calcium rich Extrudates can be prepared as per the procedure developed by Dr.BalasahebSawantKonkanKrishiVidyapeeth , Dapoli.
		(Year – 2013)
		

3. Completed research Projects/Programmes /Schemes

S.N.	Title of the project	Project expenditure (Rs. lakh)	Granting agency	Date of start	Date of completion
1	Collaborative studies in Silos, DBSKKV, Dapoli.	3.5	Shirke Constructions P.Ltd., Pune.	2007	**2011**
2	Value addition of finger millet by extrusion cooking technology at DBSKKV, Dapoli.	52	Min. of FPI, Govt. of India, New Delhi.	2009	**2014**
3	Cashew Processing Training Centre (Experential Learning Unit)	8	ICAR, New Delhi	2009	**2011**
4	Bakery Training Centre (ELU) at DBSKKV, Dapoli.	70	ICAR, New Delhi.	2009	**2011**
5	World Bank funded NAIP sub project on A value chain for Kokum, Karonda, Jamun and Jackfruit, DBSKKV, Dapoli.	256	NAIP, ICAR, New Delhi.	2009	**2014**
6	Coconut Processing Unit	90	CDB	2012	**2014**

4. **Ongoing Research Projects/Programmes/Schemes**

Followings are the ongoing research project of the Department

- Development of Cashew nut Grader
- Development of Mango stone Decorticator
- Dehydration studies on Cashew apple
- Osmotic Dehydration of Pineapple
- Development of Extrudates using millet, pulses & other fruit extracts etc.

Extension Activities

1. **Training Facilities**
   - ❖ Bakery Experiential Learning (Training) Unit
   - ❖ Coconut Processing & Training Center
   - ❖ Cashew Processing & Training Center

2. **Training Programmes organized under Skill Development by Deptt.**

Sr. No.	Training Programme	Duration (Days)	No of Trainees	Training Fee (Rs./ trainee)
1.	Coconut Processing	03	20	Rs. 500/-
2.	Cashewnut Processing	04	20	Rs. 2000/-
3.	Bakery products	05	15	Rs. 3000/-

- **Faculty & Human Resource**

Sr. No.	Name	Designation	Qualifications
1.	Dr. S.P.Sonawane	Professor and Head	B.Tech.(Agril. Engg.), M.E.(APFE), Ph.D.(PFE)
2.	Dr. S.B.Swami	Associate Professor	B.Tech.(Agril. Engg.), ME (APFE), Ph.D.(APFE),
3.	Er. A.A.Sawant* (*On Study Leave)	Assistant Professor	B.Tech.(Agril. Engg.), M.Tech.(APE)
4.	Er. S.P.Divekar	Assistant Professor	B.Tech.(Agril. Engg.), M.Tech. (PHE), PhD (PH&FPE)
5.	Er. S. B. Kalase	Senior Research Assistant,	B.Tech.(Agril.Engg.), M.E. (APFE)
6.	Shri. A.A. Uplap	Clerk (Bakery Unit)	B.Com.
7.	Shri. N. S. Kesarkar	Lab Boy	-
8.	Smt. P. P. More	Peon	-
9.	Shri. S.N. Dhotre	Peon (Bakery Unit)	-

1. **Teaching Faculties**

	Name of the Faculty	**Dr. S. P. Sonawane**
	Post Held	Professor & Head (I/C)
	Date of Birth	13.12.1973
	Qualification	B.Tech. (Agril.Engg.), M.E.(Ag) in PFE, Ph.D. (PFE),
	Area of Specialization	Processing & Food Engineering
	Experience (Years)	19 Years
	Research Projects guided	
	Ph. D.	-
	M.Sc. / M. Tech	03
	B. Tech.	12
	Present area of research	Foodgrain Storage,Bakery technologyExtrusion Cooking; Fruits and vegetable processing and value addition; Food preservation;.
	Contact details	
	Land line No.	02358 282414
	Mobile	09421610791
	Fax	02358 282414
	Email	spsonawane1@gmail.com

	Name of the Faculty	**Dr. S. B. Swami**
	Post Held	Associate Professor
	Date of Birth	17.06.1975
	Qualification	B.Tech. (AgrilEngg); M.E.(Ag).Processing and Food Engg; Ph.D.(Agril. And Food Engg.) IIT, Kgp
	Area of Specialization	Food Rheology, Food Drying, Food Hydrocolloids, Food Processing Machinery Development, MSI of Foods, Microwave vacuum drying, Supercritical Fluid Extraction.
	Experience (Years)	13 Years
	Research Projects guided	
	Ph. D.	Nil
	M.Sc. / M. Tech	03
	B. Tech.	10
	Present area of research	Development of Value added products from Kokum, Karonda, Jamun andJackfruit
	Contact details	

	Land line No.	02358 282414
	Mobile	+91-9421610082
	Fax	02358 282414
	Email	swami_shrikant1975@yahoo.co.in

	Name of the Faculty	**Er.A. A. Sawant (on Study leave)**
	Post Held	Assistant Professor
	Date of Birth	05.02.1977
	Qualification	M.Tech.
	Area of Specialization	Process & Food Engineering
	Experience (Years)	13 Years
	Research Projects guided	
	Ph. D.	Nil
	M.Sc. / M. Tech	Nil
	B. Tech.	06
	Present area of research	Extrusion cooking Technology of finger millet
	Contact details	
	Land line No.	-
	Mobile	09421232282
	Fax	-
	Email	abhimanavi@gmail.com abhi52@rediffmail.com

	Name of the Faculty	**Dr. S.P. Divekar**
	Post Held	Assistant Professor
	Date of Birth	13.05.1975
	Qualification	B.Tech. (AgrilEngg); M.Tech. (PHE), PhD.(PH&FPE, IARI)
	Area of Specialization	Post Harvest& Food Process Engg.,
	Experience (Years)	12Years
	Research Projects guided	
	Ph. D.	Nil
	M.Sc. / M. Tech	Nil
	B. Tech.	04
	Present area of research	Machine Development , Bakery Technology, Hermetic Storage
	Contact details	
	Land line No.	02358 282414
	Mobile	09657000541
	Fax	02358 282414
	Email	Santosh.divekar75@gmail.com

2. Research Staff

	Name of the Faculty	**Er. S.B.Kalse**
	Post Held	Senior Research Assistant
	Date of Birth	17.01.1986
	Qualification	M.Tech.
	Area of Specialization	Processing and Food Engineering
	Experience (Years)	04
	Research Projects guided	
	Ph. D.	Nil
	M.Sc. / M. Tech	Nil
	B. Tech.	02
	Present area of research	
	Contact details	
	Land line No.	02358 282414
	Mobile	9561144876
	Fax	02358 282414
	Email	sandeep.kalse@gmail.com

Repository of abstracts of the thesis

1. Ph. D. (Agril. Engg.) in APE

No.	**:**	01
Name of the Candidate	**:**	Mr. A.P. Chaudhari
Degree of which the thesis/project report submitted:	**:**	Ph.D.(AgrilEngg.) in APE
Year of Submission	**:**	2012-13
Name of the Guide/Co guide	**:**	Dr. N. J.Thakor
Thesis Title	**:**	**Studies of Extraction of Cashew Nut Shell Liquid.**
Abstract	**:**	

Cashew (*Anacardiumoccidentale)* is an important plantation crop of India. India has the largest area under cashew (1.923 lakh ha) and stands as the second largest producer of cashew (7 lakh MT) in the world. Today, India is the largest processor and exporter of cashew in the world. Maharashtra ranks first in the production (28.78% of the country) and productivity of cashew nut in India. Area under cashew nut in Maharashtra is confined to the Konkan region which comprises of five districts, namely, Sindhudurg, Ratnagiri, Raigad, Thane and Mumbai. Total production from these five districts is more than 1.98 lakh MT.

The cashew nut consists of kernel, shell and testa. It contains on an average 20 to 22% kernel (edible portion), 2-5% testa and 65-75% shell (outer covering). Cashew kernels are highly nutritious containing protein (21%), fat (47%), carbohydrates (22%), minerals and vitamins and hence, the cashew nuts are processed mainly for its kernel. Kernel is obtained after removing the shell of cashew nut. It is further processed by removing its testa. Shell and

the testa, therefore, are the two byproducts of the cashew nut processing. The cashew nut shell contains 25-30% dark reddish brown viscous phenolic liquid known as Cashew Nut Shell Liquid (CNSL). CNSL is a versatile by-product of cashew processing which has tremendous potential as industrial raw material with its diverse applications. Liquid from Cashew Nut shell is generally extracted by three methods namely, mechanical, roasting and solvent extraction. The expeller (mechanical) process of oil extraction is more feasible for adoption on industrial scale. R&D for oil extraction using screw press for cashew nut shell, however, is very much lacking. It is one of the hurdles for the development of cashew nut shell processing. Extraction of oil using screw press method depends on several factors, namely, moisture content of oil bearing material and its condition at the time of feeding, screw pressure, feed rate, and temperature of the material. Pre-conditioning of oil bearing material has great influence on the recovery of oil. The present investigation includes physical properties of cashew nut shells, influence of cashew nut shell moisture content and size of shell on the extraction of oil, and the influence of preconditioning of shells. The investigation was carried out at the Department of Agricultural Process Engineering, College of Agricultural Engineering and Technology, Dapoli and M/s Metafil Industries Pvt. Ltd., Dapoli. The different experiments were conducted for the given objectives. The techno-economic feasibility studies were also undertaken. The experiments were designed and statistical analysis was carried out based on the

Taguchi method using Minitab software. Experimental results revealed that the medium size cashew nut shells ranging between 16 to 20 mm are having 80% share in the commercially available cashew nut shells. It is found that cashew nut shells can be classified based on the sizes in three classes, namely, small (< 12 mm), medium (16-20 mm) and large (>20 mm). Cashew nut shell has bulk density of 314 kg/m3 and angle of repose of 23.610 at moisture content of 10.16% (wb). Thermal conductivity of cashew nut shell ranges in between 0.78 to 0.85 W/m 0C and it has calorific value of 4963 kcal/kg. The cashew nut shell liquid (CNSL) of the experimental samples was found to be **26.45%**.

The cashew nut shell moisture content has a great influence on the extraction and recovery of oil. It is found that 10.06% moisture content (wb) in shells is the optimum moisture content for extraction of oil from shells in order to get the maximum oil recovery of 86.68%. Besides shell moisture content, size is also having influence on the extraction of oil in screw press. Recovery of oil for large size cashew nut shells was highest (88.54%). Preconditioning of cashew nut shells before the extraction of CNSL had a great influence on the recovery of oil. Highest oil recovery of 93.46% was obtained in the cashew nut shells heated at 90 0C and recovery of90.87% was obtained in the cashew nut shells exposed to the steam for 15 minutes.

It was found that screw press method is better than hot oil bath method which yields more oil and gives better quality of oil. The screw press method of oil extraction for cashew nut shells gave 87% of oil recovery. It was higher by 47% than the oil recovery of hot oil bath method.The quality analysis of CNSL extracted by screw press method showed that the specific gravity of the crude CNSL was 0.98. The specific gravity of the purified CNSL was 0.96. The viscosity of the crude CNSL was 57.43 cP and that of purified CNSL was 28.96 cP. The ash content of the purified CNSL was 0.62%. The quality analysis of CNSL extracted by hot oil bath method showed that the specific gravity of the CNSL was 0.96. The viscosity of the CNSL was 37.69 cP. The ash content of the CNSL was 0.38%.

Statistical Analysis based on Taguchi method indicated that cashew nut shell of large size steamed for 15 minutes and heated at 90 ^{0}C for 10 minutes was the optimum condition for

highest yield of oil. ANOVA results revealed that all control factors have significant effects on the yield of CNSL from shells. The techno-economic analysis for the extraction of CNSL by screw press method indicated that the production cost for processing a tonne of cashew nut shells per annum is Rs. 4606/- i.e. Rs 4.60 per kg of shells. It is Rs. 3920/- in case of hot oil bath method. Hot oil bath method gives CNSL recovery of 40% as against 87% that of Screw Press method. Processing one tonne of the cashew nut shells using hot oil bath method gives 108 kg of CNSL and screw press method gives 235 kg. Screw press method gives more and better quality oil per kg and is suitable for immediate industrial adoption. Preconditioning of cashew nut shells and grading based on size gives better recovery and quality oil when extracted at optimum shell moisture of 10%

2. M.**Tech**. (Agril. Engg.) in APE/PFE

No.	**:**	01
Name of the Candidate	**:**	Miss. S.A. Sane
Degree of which the thesis/project report submitted:	**:**	M.Tech.(APE)
Year of Submission	**:**	2005-06
Name of the Guide/Co guide	**:**	Dr. N.J.Thakor
Thesis Title	**:**	Design, Development and Performance Evaluation of Copra Dryer.
Abstract	**:**	

Drying is an important unit operation that increases the shelf life and quality of an agricultural commodity. Stored material deteriorates because of growth of microorganisms, insects or mites. Drying reduces the amount of moisture content in the commodity upto safe level by supplying the heat energy. Coconut is dried under gradual change of temperature from 55 to 70 ºC.

A study was conducted in a Dapolitaluka of Ratnagiri district to evaluate the conventional drying practices of copra making. In order to give the better solution for copra making rather than conventional methods a small-scale lab model of combined combustion and drying unit was designed, fabricated and tested. The survey was done in a Dapolitaluka to study the traditional methods of copra making. There were two common methods of copra making i.e. Sun drying and Chula drying. There were some limitations observed in the methods. The suitable dryer was developed for copra making in the Konkan region. The maximum temperature recorded in the drying chamber due to heating was 70ºC during the test period. The furnace was fired with coconut waste i.e. coconut husk and coconut shells. The moisture content of the coconut was reduced from 55% w.b. to 6% w.b. in the drying period. It was observed that average 35 hours required for the drying with average 120 kg of fuel. The quantity of drying air required was 900 kg throughout drying period. The efficiency of the dryer was calculated by taking three trials of drying. The thermal efficiency of the dryer was observed to be 25. 20%. The copra was graded as 55% white copra, 31% brown copra and 14% dusty copra. Although the thermal efficiency is not so satisfactory, the dryer was found

better compared to traditional methods due to the quality of final product and the ability to perform under adverse environmental conditions.

No.	**:**	02
Name of the Candidate	**:**	Miss. V.K. Sonavane
Degree of which the thesis/project report submitted:	**:**	M.Tech.(APE)
Year of Submission	**:**	2005-06
Name of the Guide/Co guide	**:**	Dr. S.P. Sonawane
Thesis Title	**:**	Performance Evaluation of GIC silos for Wheat against CAP and Godown storage
Abstract	**:**	

The objectives of this investigation were to study the grain storage for the humid climate of Konkan region, to study the influence of the storage methods on the properties of wheat grain and to study the influence of whether and storage methods on the grain quality.
To achieve these objectives wheat grains of var. Lok 1 were stored in three different storage methods viz. GIC silo, CAP and Godown. The grain were stored for a period of five months. To reach the objectives: temperature, RH, moisture content, engineering properties viz., bulk density, true density, angle of repose, 1000 grain weight, milling quality, germination percentage, percentage infestation, insect count, percentage weight loss, food quality in terms of protein content, fat content, and ash content were assessed.

The temperature followed a rising trend with the storage period in all the storages. The moisture content also increased with increased in storage time. The moisture content in the silo was maintained lower than the other two methods. The germination percentage was higher in the silo and it was lower in the CAP storage. Insect damage to grain was low in silo and was higher in CAP. The insect count was low in silo as compared to CAP. The milling quality showed a irregular change in the three storages, but there was a increase in the percentage of fibre. The increase in fiber percentage was less in silo and it was higher in CAP. The protein content did not vary much but reduced to a very small extent. The decrease was less in silo and it was higher in CAP. The fat content did not show any change. The ash content increased with the increase in storage period. The increase was less in silo and it was higher in CAP.

No.	**:**	03
Name of the Candidate	**:**	Mr. S.D. Javeer
Degree of which the thesis/project report submitted:	**:**	M.Tech.(APE)
Year of Submission	**:**	2006-07
Name of the Guide/Co guide	**:**	Dr. S.P. Sonawane
Thesis Title	**:**	Storage Behaviour of Wheat in Long Term Storage in GIC Silo, CAP and Godown methods.

Abstract	**:**	

The present investigation was undertaken with specific objectives to study the wheat storage for the humid climate of Konkan region, to study the influence of storage methods on the properties of wheat grain and to study the influence of weather and storage methods on wheat grain quality.Wheat grain (Variety - Lok1) was stored in three different storage methods viz., GIC silo, CAP storage and Godown. The grain was stored for a period of twelve months. The data on physical variables (temperature, RH, moisture content), engineering properties (bulk density, true density, angle of repose, 1000 grain weight, porosity), quality of grain (germination percentage, insect infestation, insect count), milling quality (percent extraction rates of flour, semolina and fiber) and food quality (protein content, fat content and ash content) of wheat stored were recorded before and after storage.

The temperature of wheat stored in all the three storage structures increased, as the storage period advanced (Initial temperature-29.3˚C, at the end of storage period temperature in silo- 42.90˚C, in CAP storage- 39.94 ˚C, in godown- 32.31˚C). The effect of outside or ambient temperature was less on the temperature of wheat stored in silo as compared to godown and CAP storage. The bulk density and true density both remains almost same for initial five and three months storage respectively and after that both the densities followed the decreasing trend. However the extent of decrease in the value of bulk density and true density of wheat stored in silo was lower than the wheat stored in godown and CAP storage.

Due to the insect infestation in stored wheat, thousand grain weight showed the decreasing trends in all the three storages. High rainfall and relative humidity of this coastal area caused growth of insects in the wheat stored in storage structures. The germination percentage declined in all three storage method. This is because the insects ate the germ of grain. However better germination percentage of wheat stored in silo was maintained through out storage period as compared to godown and CAP storage method. Protein content was better in the wheat stored in silo (6.84%) than the wheat stored in godown (3.38%) and CAP storage (3.15%). Fat content of wheat stored in all the three storages decreased.

The flour extraction from stored wheat was declined while extraction rates of fiber in wheat stored in silo, CAP storage and Godown increased. The wheat stored in all the three methods was found to be infested at the end of twelve months storage. However the wheat stored in silo was infested comparatively lower because wheat in silo had very little effect of change in ambient conditions (temperature and RH). Thus the quality of the wheat stored (in term of insect infestation, germination percentage and food value) in silo was better maintained than CAP storage and Godown.

No.	**:**	04
Name of the Candidate	**:**	Miss. S.K. Sawant
Degree of which the thesis/project report submitted:	**:**	M.Tech.(APE)

Year of Submission	**:**	2008-09
Name of the Guide/Co guide	**:**	Dr. N.J.Thakor
Thesis Title	**:**	Testing & Development of CAET, Dapoli Developed Copra Dryer using Coconut Husk as a fuel
Abstract	**:**	

Copra drying in Konkan region is practiced largely through sun drying and chula drying which has its own demerits while use of mechanical copra dryer is very scarce. Konkan region has more than 100 rainy days of the year with average rainfall of 3000 mm (40-140 mm/hr) and sun drying during rainy season is for coconuts harvested in rainy season is impossible. There is need to have a simple mechanical batch type copra dryer suited to the requirements of Konkan farmers having small land holding. The department of Agricultural Process Engineering of Dr, BSKKV Dapoli developed batch type indirect force convection copra dryer through research studies of PG student.

The present study is the investigation carried out on the performance testing of CAET developed copra dryer and improvement and testing of the modified CAET copra dryer. During testing it is observed that CAET developed copra dryer can be completed drying operation by using 120 kg coconuts husk as a fuel to dry 8 kg batch of coconut halves. The CAET developed copra dryer removed 134 g moisture per hour from 8 kg coconuts halves. Average 30 kg fuel consumed to remove 1 kg of water from coconut halves from initial moisture content 50 per cent to 6 percent final moisture content. Also convection of heat from heating chamber to drying chamber through one single pipe limits the utilization of available heat energy in the heating chamber for drying of coconut halves. It is observed that 40-45 per cent heat loss (1500 W) found from heating chamber walls due to lack of insulation. Total space required for dryer unit is 3 m^2, which create difficulty in movement from one place to another.

Modified CAET copra dryer relatively require less space (0.81 m^2) and dryer provide with Castor wheel for easy movement from one place to another. It is observed that heat loss through heating chamber walls 150 W and saving in heat energy of 10 times (1000 W) over the CAET developed copra dryer. Drying operation with modified CAET copra dryer can be completed by using a very less amount of fuel (Coconut husk) of 20 kg to dry 16 kg batch of coconut halves and saving in fuel by 6 times over the CAET developed copra dryer. The modified CAET copra dryer removed 267 g moisture per hour from 16 kg coconuts halves. Average 4 kg fuel consumed to remove 1 kg of water from coconut halves from initial moisture content 50 per cent to 6 per cent final moisture content. The drying capacity (16 kg coconut halves copra / batch) of modified CAET copra dryer is two times higher than the CAET developed copra dryer. In the CAET developed copra dryer the use of blower is necessary to convey the heat from heating chamber to drying chamber however heat can be convey from heating chamber to drying chamber in the modified CAET copra dryer without using the blower or in the absence of blower. Modified CAET copra dryer can be used by

indirect natural convection batch type method. Percentage of white copra found 72 per cent after drying operation of modified CAET copra dryer and improving 15 per cent quality of copra over the CAET copra dryer. Modified CAET copra dryer is providing efficient drying and has large drying capacity and potential fuel saving ability also use with natural convection indirect batch type method.

No.	**:**	05
Name of the Candidate	**:**	Mr. A. N. Deshbhratar
Degree of which the thesis/project report submitted:	**:**	M.Tech.(APE)
Year of Submission	**:**	2009-10
Name of the Guide/Co guide	**:**	Dr. N. J. Thakor
Thesis Title	**:**	Storage Changes of Paddy in GIC silo & Bag Storage under Konkan climatic conditions,
Abstract	**:**	

The present study was undertaken with the objectives to study the paddy storage for the humid climate of Konkan region, to study the influence of storage methods on the properties of paddy grain and to study the influence of weather and storage methods on paddy grain quality.Paddy grain was stored in two different storage methods viz., GIC silo and Bag storage. Ratna variety of paddy was used for this study. The grain was stored for a period of eight months. To reach the objectives physical variables (temperature, Relative humidity, moisture content), engineering properties (bulk density, true density, terminal velocity, 1000 grain weight, porosity), quality of grain (germination percentage, percentage infestation, insect count, milling quality (broken, total yield, head yield) and food quality (protein content, fat content, fiber content, ash content and protein content) were assessed.

As the storage period advanced, temperature in all Silo1, Silo2 and Bag storage storages increased. Moisture content and Relative humidity were more in rainy season and after rainy season both decreased. As the storage period advanced, Bulk density and True density followed decreasing trend. Thousand grain weight and Terminal velocity also decreased with the increase in the storage period. Germination also decreased with the increase in the storage period. The Broken and Head yield increases as increase in storage period. Higher percentage of protein content was observed in Godown than Silo (1 and 2). Fat content also decreases with the increase in storage period. The ash content increased with the increase in storage period.It is observed that the initial investment for the silo storage system is higher than that of Godown grain storage system. Silo bulk storage system required initial investment of Rs. 4549 per tonne of paddy while godown grain storage system required Rs. 3338 per tonne paddy grain. It is higher by 36.3 per cent over Godown system. Operating cost, however for Silo storage system is much lower than that of Godown storage system. Operational cost for Godown grain storage system is Rs. 1306.1 per tonne of paddy and that for Silo Bulk storage system is Rs. 364. It is 27.9 per cent lower than that of godown system. It is also

observed that the losses of grain are higher is Godown storage system to the tune of 19.5 per cent these are due to handling and deterioration of grains by rats, insects, pests and microbial activities. The grain value of the paddy lost in Godown storage system on account of storage for period of one year is Rs.540 per tonne of paddy and that in the Silo storage system is Rs.105 per tonne of paddy. Economical evaluation clearly indicates than the value of grain is about five times higher in case of Godown storage system that of Silos storage system. Storage loss to the tune of 145 tonnes of paddy can be avoided when Silo bulk storage system is preferred over Godown bag storage system of the 5000 tonne capacity. This means 29 kg of paddy grains for every 1000 kg storage could be retained with the help of Silo storage system. Silo system provides 3 % of grain saving from storage loss.

India produces 100 million tonnes of paddy on an average every year. Considering 50 % of this, is stored annually in Godown bag storage system. Saving at the rate of 3 % would be 15 lakh tones of paddy if silo system of storage adopted. The grain value of 15 lakh tonnes paddy at the rate of Rs 15,000 per tonne would be Rs 2250 crores every year. This indicates that the silo storage system though require higher initial investment is certainly economical and beneficial for storage of grains. Cost of silos at the rate of Rs 5000 per tonne for 10,000 tonnes could be Rs 5 crores. About 450 silos of 10,000 tonnes capacity could be built up merely from the amount of grain value lost during the storage.

No.	**:**	06
Name of the Candidate	**:**	Mr. S. C. Patil
Degree of which the thesis/project report submitted:	**:**	M.Tech.(APE)
Year of Submission	**:**	2010-11
Name of the Guide/Co guide	**:**	Dr. N. J. Thakor
Thesis Title	**:**	Long term Storage changes of Paddy in GIC silo & Bag Storage under Konkan climate conditions.
Abstract	**:**	

The objectives of this investigation were to study the behavior of paddy grain in GIC silo and bag storage system for Konkan region under long term storage andto study the effect of aeration and weather parameters i.e. temperature and relative humidity on qualities of the paddy grains.To achieve these objectives the storage performance of paddy in GIC silo and godown storage was studied. Paddy was stored for long term duration (from July 2008 to January 2010) of 18 months and changes in paddy were observed. Ratna variety of paddy was used for this study. To reach the objectives the physical variables (temperature, RH, moisture content), grain properties (bulk density, true density, porosity, terminal velocity, 1000 grain weight), germination percentage, percentage infestation, insect count, milling quality (husk content, broken, total yield, head yield) and nutritional quality (protein, fat, fibre, ash and carbohydrate content) were assessed.

The monthly variation of temperature of ambient air for the storage period was from

27.2 to 32.4°C. Variation of average monthly temperature in case of silo storage for the given storage period was from 27.0 to 30.5°C. The difference in temperature over the period was 3.5°C. Variation of average monthly temperature in case of bag storage method of paddy for the given storage period was from 26.9 to 31.9°C. The difference in temperature over the period was 5°C. Fluctuation of temperature in silo was less compared to bag storage methods. Relative humidity was observed higher in rainy season. The moisture content in both storage systems is varied with the storage period. The moisture content in the silo was lower than that in bag storage. Bulk density followed decreasing trend. Thousand grain weight also decreased with the increase in the storage period. The thousand grain weight decreased from 19.3 g to 18.4 g (4.6%) in Silo and 19.1 g to 17.6 g (7.8%) in bag storage. The germination content was decreased with increase in the storage period in both silo and bag storage. The germination of paddy decreased in silo as from 70.6% to 52.3% (25.9%) and 69.5% to 49.3% (29.0%) in bag storage.

Insect infestation was lower in silo than bag storage. The broken content was higher in bag storage than silo storage. The protein content was decreased with the storage period. The protein content decreased from 8.78 % to 7.89% (10.1%) in silo storage and 8.33% to 7.40% (11.1%) in godown storage. The ash content was increased with the increase in storage period. The increase was less in silo and it was observed higher in bag storage. The difference in relative humidity inside the silo over ambient was 7% however in case of paddy stored in bags was nearly about 2%. The study indicates that silo acts as good barrier for moisture or relative humidity and provides better quality of stored grain under humid conditions.In general for large capacity GIC silos (3000-5000T) initial investment (capital cost) is almost equal. Cost of operation and maintenance (recurring cost) is 2 times in case of godowns over silos and cost due to losses are 4 to 5 times more times in godowns.

No.	**:**	07
Name of the Candidate	**:**	Mr. H. D. Rupanawar
Degree of which the thesis/project report submitted:	**:**	M.Tech.(PFE)
Year of Submission	**:**	2011-12
Name of the Guide/Co guide	**:**	Dr. N. J. Thakor
Thesis Title	**:**	Preservation Studies of Jackfruit bulbs (*Artocarpusheterophyllus* L.) by Different Processing Techniques
Abstract	**:**	

The objectives of this investigation were to study the preservation of Jackfruit bulbs (*Artocarpusheterophyllus* L.) by different processing techniques. To achieve these objectives the physical properties of both unripe and ripe Jackfruit and its component (bulb, seed, and carpel) were measured. Kappa variety of Jackfruit was used for this study. The preservation techniques for Jackfruit bulbs were Tray drying, Microwave drying, Osmotic dehydration and

Edible coatings were applied. To reach the objectives the physical properties dimensions, weight, volume, True density and bulk density were studied. In tray drying and microwave vacuum drying method drying rate, shrinkage, colour, TSS hardness and sensory evaluation were determined. Also, in combination of osmotic and tray drying method moisture loss, mass reduction, solid gain, drying rate, shrinkage, colour, TSS and hardness were assessed. In coating techniques two type coatings corn starch and carrageenan were used. The samples coated were packed in packaging material polyethylene 250 gauge and polyethylene 100 gauge. The Physiological weight loss, TSS, pH, O_2 and CO_2 Gas composition and sensory evaluation were measured.

Physical properties of Jackfruit and its components both ripe and unripe were measured. It was observed that weight, volume, of unripe Jackfruit, Bulb, Seed and Carpel was reduced after ripening but True density and bulk density was increased. The components of unripe Jackfruit were carpel 35 %, seed 13 % and inedible portion (rind, core, mesocarp, latex) was 52 %. The share of bulb was equal to sum of share of carpel and seed.The tray drying of Jackfruit bulbs (with seed) was done at three different temperatures 45^0C, 55^0C and 65^0C. The drying time required for drying temperature 45^0C, 55^0C and 65^0C was 41.5 h, 33.5 h and 27.5 h respectively. On the different attributes shrinkage, colour, TSS, hardness it was conclude that the tray drying of Jackfruit bulbs at 55^0C was best.The microwave vacuum drying of Jackfruit bulbs (with seed) was done at three different conditions of magnetrons 15s on/30s off, 20s on/ 30s off and 25s on/30s. The time required for drying of bulbs up to constant weight loss was 86 min, 69 min and 56 min for 15s, 20s and 25s respectively. On the different attributes colour, TSS, hardness it was conclude that the microwave vacuum drying of Jackfruit bulbs at 20s on/ 30s off was best.

The combination of osmotic and tray drying of Jackfruit bulbs (with seed) was done. The osmotic dehydration was performed at three different osmotic solutions (sugar) 40^0Brix, 50^0Brix and 60^0Brix. The dipping of bulb in to osmotic solution was done for 3 h and after the osmotic dehydration the bulbs were Tray dried in Tray dryer at temperature 55^0C. The time required for drying of bulbs was 30.5 h, 28.5 h and 26 h respectively for 40^0Brix, 50^0Brix and 60^0Brix respectively. On the different attributes colour, TSS, hardness it was concludes that the osmotic dehydration of Jackfruit bulbs at 50^0brix was more suitable.The edible coated Jackfruit bulb by corn starch was more suitable to Jackfruit bulbs than carrageenan coating. The shelf life of corn starch coated bulb extended for corn starch was 22 days. Also, shelf life of carrageenan coated bulb was extended for 7 days same for polyethylene 250 gauge and 100 gauge. The shelf life of bulbs without any coating was extended for 11 days for polyethylene 250 gauge and 10 days for polyethylene 100 gauge. It shows the packaging material polyethylene 250 gauge is better than polyethylene 100 gauge for Jackfruit bulbs.

No.	**:**	08
Name of the Candidate	**:**	Miss. M. D. Katkar

Degree of which the thesis/project report submitted:	**:**	M.Tech.(PFE)
Year of Submission	**:**	2011-12
Name of the Guide/Co guide	**:**	Dr. N. J. Thakor
Thesis Title	**:**	Organoleptic Studies of Tender Cashew Kernel and Mature Soaked Cashew Kernel.
Abstract	**:**	

The demand for green (tendor) cashew kernel is increasing from last 4 to 5 years. People like the taste of tendor cashew kernel for making curry and pay even higher prices for it. Hence, tendor cashew kernels fetch more price than mature. As it is available for very short time period, there is necessity to develop an alternative for it. So, it was felt to explore the organoleptic evaluation of tendor cashew kernel and study the characteristics to compare with the mature cashew kernel. The objectives of present study were to study the physical properties of tendor cashew kernel and mature cashew kernel, to carry out sorption studies of soaked mature cashew kernel, to carry out soaking studies of mature cashew kernel, to study the textural and cooking characteristics of mature soaked cashew kernel and organoleptic evaluation of cooked tendor cashew kernel and mature soaked cashew kernel.

To reach the objectives of physical properties; moisture content, dimensions, single kernel weight and 100 kernel weight of tendor and mature cashew kernel were determined. Mean diameter, surface area, sphericity and shape of cashew kernels were calculated from the measured dimensions. Nutritional properties of tendor cashew kernel and mature cashew kernel were also determined. To fulfill the objective of sorption studies, mature cashew kernel stored in hot air oven at 30, 40, 50 and 60°C temperatures with desiccator having saturated salt solutions for 40, 50, 60, 70, 80 and 90 % relative humidities. Soaking studies of mature cashew kernel were carried out in thermostatic water bath at 30, 45 and 60°C temperatures and 1:6, 1:7, 1:8 and 1:9 soaking ratios. After soaking of mature cashew kernel, its dimensional changes determined with vernier calliper and image analysis software. Colour measurement also carried out. Textural characteristic i.e. Hardness of tendor cashew kernel and mature soaked cashew kernel was measured with the help of universal testing machine. Cooking characteristics namely minimum cooking time, volume expansion ratio, length expansion ratio and water uptake ratio were determined. Organoleptic evaluation of tendor cashew kernel and mature soaked cashew kernel were carried out.

Moisture content of tendor cashew kernel was 100 % (db) and that of the mature cashew kernel was 5.40 % (db). Length of tendor cashew kernel was 27.27 mm, breadth was 12.46 mm and thickness, 10.71 mm. Mature cashew kernel has length 25.91 mm, breadth 10.97 mm and thickness 9.37 mm. Mature cashew kernel has less mass than tendor cashew kernel. Hundred kernel weight of tendor cashew kernel was 217 g and that of mature cashew kernel was 182.94 g (W-240).

The equilibrium moisture contents of mature cashew kernel were found to be increasing with increase in relative humidity and decreased with increase in temperature. At 30^0C, value of equilibrium moisture content was increased from 6.47 to 8.90 % as relative

humidity increased from 40 to 90 %. At 40°C, these values increased from 6.74 to 8.80 % and 6.99 % to 8.75 % at 50°C temperature. At 60°C equilibrium moisture contents of mature cashew kernel were increased from 7.03 to 8.72 % with increase in relative humidity.

The soaking studies of mature cashew kernels showed significant difference in final moisture content and soaking time as temperature of soaking was increased from 30 to 60°C. At 30°C soaking temperature, time required to attain saturation stage was 360 minutes and final moisture content values varied from 34.36 % (db) to 36.66 % (db) as soaking ratio increased from 1:6 to 1:9. Soaking time required was 300 minutes for 45°C temperature and 170 minutes for 60°C temperature. Final moisture content was varies from 41.05 to 41.45 % (db) for 45°C temperature as per soaking ratio and 47.84 to 48.65 % (db) for 60°C temperature.

Hardness of tendor cashew kernel was 15.95 N before cooking and 2.28 N after cooking. In case of mature soaked cashew kernel hardness was in the range of 17 to 21 N before cooking and 3.76 to 2.71 N after cooking. Tendor cashew kernel required 36 minutes for cooking and mature cashew kernel soaked at 30, 45 and 60°C required 57 to 44 minutes for cooking. Volume expansion ratio for tendor cashew kernel was 1.31 and for mature soaked cashew kernels it was ranged between 1.37 to 1.15. Length expansion was not significantly observed in both types of cashew kernels. Water uptake ratio was higher for mature cashew kernel soaked at 30°C as compared to 60°C temperature.

Organoleptic evaluation of tendor cashew kernel and mature cashew kernels soaked at 30, 45 and 60^0C were carried out for hardness. Mature cashew kernel soaked at 30^0C with 1:9 soaking ratio was proved best as per the sensory scores.

No.	**:**	09
Name of the Candidate	**:**	Miss A.D. Divate
Degree of which the thesis/project report submitted:	**:**	M.Tech.(PFE)
Year of Submission	**:**	2012-13
Name of the Guide/Co guide	**:**	Dr. N. J. Thakor
Thesis Title	**:**	Development of Extruded Product from Finger Millet based Composite Flour
Abstract	**:**	

No.	**:**	10
Name of the Candidate	**:**	Mr. M. M. Mali
Degree of which the thesis/project report submitted:	**:**	M.Tech.(PFE)
Year of Submission	**:**	2013-14
Name of the Guide/Co guide	**:**	Dr. N. J. Thakor
Thesis Title	**:**	Influences of Extrusion Processing Parameters on Finger Millet based Extrudates Products.

Abstract	**:**	

No.	**:**	11
Name of the Candidate	**:**	Ms. A. R. Hande
Degree of which the thesis/project report submitted:	**:**	M.Tech.(PFE)
Year of Submission	**:**	2013-14
Name of the Guide/Co guide	**:**	Dr. S. B. Swami
Thesis Title	**:**	Preservation of Kokum Rind by Different Drying Methods
Abstract	**:**	

In the present research work, preservation of kokum rind (Amrita S-8) was done by drying process. Kokum rind was dried by three different drying methods i.e. sun drying, solar drying and tray drying method. Tray drying was carried out at 60^0C temperature and 2 m/s air velocity. All experiments were performed at College of Agricultural Engineering and Technology, Dapoli. Quality parameters (Acidity, pH, reducing sugar, non reducing sugar, protein, fat, carbohydrates, ash, anthocyanin, colour, calorific value etc.) after drying were also evaluated which indicate that the quality parameters of solar and tray drying methods were good as compared with sun drying of kokum rind.

An attempt was made to evaluate drying characteristics of kokum rind during all drying methods. Study of drying kinetics was done which include moisture content versus time, drying rate versus moisture content and moisture ratio versus drying time. Tray drying took 24 h to complete drying process while solar drying and sun drying took 34 and 38 h respectively. Convective heat surface transfer coefficient for sun, solar and tray drying was 168.97±29.85, 334.65±39.12 and 1585.15±757.15 W/m^2 ^{0}C, respectively. Highest moisture diffusivity was observed in tray dried kokum rind with 5.56×10^{-9} m^2/s as compare to solar and sun drying method with 3.18×10^{-9}, 2.39×10^{-9} m^2/s, respectively. Henderson and Pebis model was found best fitted to sun (*RMSE*=0.0004; r^2= 0.998) drying of kokum rind while Page was best fitted to solar (*RMSE*= 0.0010; r^2= 0.9971) and tray (*RMSE*= 0.0009; r^2= 0.9976) drying of kokum rind.

Storage study of dried kokum rind after packing in gunny bags, nylon bags and plastic jars were also carried out up to 9 month and its effect on quality parameters i.e. acidity, pH, TSS, reducing sugar, non reducing sugar, colour (L, a and b) and calorific value were evaluated. These quality parameters were tested at 3 month interval. Plastic jar packaging material found best for storage of kokum rind upto 9 month as compared with nylon and gunny bag. There was deterioration of quality parameters i.e. acidity, non reducing sugar, lightness, redness and calorific value as increase in storage period from 0 to 9 month however the TSS and b value increases as storage duration increases.

Keywords: Kokum rind, sun drying, solar drying, tray drying, anthocyanin, calorific value.

No.	**:**	12
Name of the Candidate	**:**	Miss P.S. Deshmukh
Degree of which the thesis/project report submitted:	**:**	M.Tech.(PFE)
Year of Submission	**:**	2014-15
Name of the Guide/Co guide	**:**	Dr. S. B. Swami
Thesis Title	**:**	Development of Jackfruit Seed Flour by Different methods
Abstract	**:**	

In the present research work, "Development of jackfruit seed flour by different methods" was done by different drying methods i. e. drying by convective hot air; and steaming and drying of jackfruit seed. Two types of jackfruit seeds i.e. firm flesh (*Kapa)* and soft flesh (*Barka)* seeds were used for the study. Initially the physical properties of firm flesh (*Kapa*) and soft flesh (*Barka*) type of jackfruit seed was determined at five different moisture content. The geometric properties (i. e. linear dimensions, sphericity, geometric mean diameter and surface area), gravimetric properties (i. e. bulk density, true density and porosity) and frictional property (i. e. angle of repose) were determined at moisture content 9.4, 19.9, 35.9 65.8, 101.7 (% db) for firm flesh (*Kapa*) and at 11.3, 37.3, 52, 89.5 and 130.6 for soft flesh (*Barka*) type of jackfruit seeds. The geometric properties increases with increase in moisture content for both the types of jackfruit seeds. Bulk density, true density increases with increase in moisture content while porosity decreases with increase in moisture content in both firm flesh (*Kapa*) and soft flesh (*Barka)* types of jackfruit seeds. Jackfruit seed flour for two types of jackfruit seeds i. e. firm flesh (*Kapa*) and soft flesh (*Barka*) were prepared by two methods of drying i. e. convective hot air drying and steaming and drying methods followed by the particle size reduction to convert dried and steamed and dried jackfruit seed into flour.

For the flour preparation of jackfruit seed two methods was used. In first method drying of jackfruit seed i. e. firm flesh (*Kapa*) and soft flesh (*Barka)* was carried out at 60, 90 and 120^0 C and in second method steaming at 16, 19 and 22 minutes duration was done followed by drying at 60^0 C. Nutritional properties (Protein, fat, fibre ash, and carbohydrate etc.) and functional properties (i. e. water absorption capacity, oil absorption capacity, flour dispersibility, bulk density, foaming capacity, foam stability and whiteness index) after drying of seeds and converted into flour of average particle size were also evaluated which indicate that the parameters of firm flesh (*Kapa)* at 120^0C and soft flesh (*Barka*) at 90^0C temperature shows more retention of nutritional and functional properties in first method.

The drying characteristics of firm flesh (*Kapa*) and soft flesh (*Barka*) type jackfruit seed at temperature 60, 90 and 120^0 C by using convective air drying and steaming duration 16, 19 and 22 minute followed by drying at 60^0 C. The drying characteristics of both these methods indicated that in both type of jackfruit seeds i. e. firm flesh (*Kapa*) and soft flesh

(*Barka*) the drying occurred only in falling rate period. Effective diffusivity (D_{eff}) for firm flesh (*Kapa*) type jackfruit seeds were 1.37×10^{-9}, 5.52×10^{-9} and 1.79×10^{-8} m^2/s and for soft flesh (*Barka*) type jackfruit seeds were 1.43×10^{-9}, 5.72×10^{-9} and 2.02×10^{-8} m^2/s by convective hot air drying method at 60, 90 and 120^0 C temperature respectively. Effective diffusivity (D_{eff}) for firm flesh (*Kapa*) were 1.38×10^{-9}, 2.76×10^{-9} and 4.14×10^{-9} m^2/s and for soft flesh (*Barka*) were 1.43×10^{-9}, 2.86×10^{-9} and 4.29×10^{-9} m^2/s at steaming time 16, 19 and 22 minutes followed by drying at 60^0 C respectively. Henderson and Pabis model was best fitted among the fitted models (i. e. Lewis model, Page model and Henderson and Pabis model) to the data on drying (60, 90 and 120^0 C); and steaming (16, 19 and 22minutes) and drying of firm flesh (*Kapa*) and soft flesh *(Barka*) type jackfruit seed at 60^0 C.

Storage study of firm flesh (*Kapa*) and soft flesh (*Barka*) after packing in polyhtene and aluminum laminated pouches were also carried out up to 3 month and its effect on functional properties i.e. water absorption capacity, oil absorption capacity, flour dispersibility, foaming capacity, bulk density and whiteness index were also evaluated. These quality parameters were tested at 0, 15, 30, 45, 60, 75 and 90 days interval. There was decrease of functional properties i.e. water absorption capacity, flour dispersibility, foaming capacity and whiteness index and oil absorption capacity as increase in storage period from 0 to 90 days. The functional properties like, water absorption capacity, flour dispersibility, foaming capacity, whiteness index decreases significantly at $p\leq0.01$ with storage duration in both packaging material for firm flesh *(Kapa*) and soft flesh (*Barka)* type of jackfruit seed flour. Decrease in functional properties with increase in storage period from 0- 90 days were higher in polythene pouches than aluminium laminated pouches for both soft flesh (*Barka*) and firm flesh (*Kapa*) type jackfruit seed flour. Irrespective of the storage duration in both firm flesh (*Kapa)* and soft flesh (*Barka*) stored jackfruit seed flour retention of more functional properties (i. e. water absorption capacity, oil absorption capacity, flour dispersibility, foaming capacity and whiteness index) was observed in aluminum pouches.

(Keywords:Jackfruit seed, geometric diameter, nutritional and functional properties, drying, steaming and drying, storability of jackfruit seed flour).

No.	**:**	13
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Degree of which the thesis/project report submitted:	**:**	M.Tech.(PFE)
Year of Submission	**:**	2015-16
Name of the Guide/Co guide	**:**	Dr. S. B. Swami
Thesis Title	**:**	Development of Arrowroot- Lesser yam – Potato based Extruded Products
Abstract	**:**	

In the present research work, “Development of Arrowroot, Lesser yam and Potato based extruded products” was done from tuber crops i.e. arrowroot, lesser yam and potato

flours at extrusion temperature 130, 150 and 170°C and screw speed 330, 360 and 390 rpm. Preparation of flour from this tuber crops by using the convective hot air dryer (tray dryer) at 60°C. The drying kinetics of arrowroot, lesser yam and potato slices in terms of moisture content verses drying time and moisture content verses drying rate was investigated. A convective hot air dryer (tray dryer) were employed to study the drying behavior at 60°C. The arrowroot, lesser yam and potato tuber crop slices were dried from an initial moisture content of 124.42% (db) to 7.61% (db); 361.71% (db) to 9.56% (db) and 243.85% (db) to 6.10% (db) respectively. It took around 8.25 h, 7.75 h and 9.25 h for drying of arrowroot, lesser yam and potato respectively by tray drying at 60°C. Physicochemical and functional properties of flours extracted from arrowroot, lesser yam and potato were investigated. Examination of the functional properties of prepared flours from arrowroot, lesser yam and potato blend in the ratio of 100:00:00, 00:100:00, 00:00:100, 00:50:50, 10:40:50, 20:30:50:, 30:20:50, 40:10:50 and 50:00:50 respectively were carried out. The nutritional properties of the flour combinations e.g. protein 2.27-5.36%, fat 0.23-0.98%, fiber 0.48-3.86%, ash 1.91-4.14%, moisture content 5.81-8.56% and carbohydrates 79.81-86.66% respectively. The functional properties of the flour combinations e.g. water absorption capacity 1.36-2.46ml/g, oil absorption capacity 0.63-1.56ml/g, bulk density 2.41-4.31g/cm^3, flour dispersibility 24.33-41.33% and yellowness index 21.81-32.16 respectively.

Extrusion cooking has been carried out at extrusion temperature 130, 150 and 170°C, screw speed 330, 360 and 390 rpm and flour combinations of Arrowroot flour, Lesser yam flour and Potato flours. Potato flour has been taken as base flour 50% and rest of the two flours varied i.e. Arrowroot flours were (0, 10, 20, 30, 40 and 50%) and Lesser yam flour (50, 40, 30, 20, 10 and 0%). These three flour combinations at 10% MC (db) were extruded using twin screw extruder at screw speed 330, 360 and 390 rpm and barrel temperature 130, 150 and 170°C. The extrudates were analyzed for its functional properties (water absorption index, water solubility index, expansion ratio, bulk density and hardness) and physico-chemical properties (moisture content, protein, fat, crude fibre, ash content, carbohydrates and colour). The sensory analysis of the developed extrudates was performed through a panel of 45 trained judges for all 54 samples. The extrudates were optimized for its desirable better functional and nutritional properties (like lower bulk density, more expansion ratio, lower hardness; protein, fat, fibre, ash and carbohydrates). The optimum extrudates combination was observed at flour combination (Arrowroot:Lesseryam:Potato as 10:40:50) at screw speed 385-390 and temperature 130-135°C. The functional properties at optimum zone was bulk density 0.15 g/cm^3, expansion ratio 3.10, hardness 1460g, water absorption index 4.22g/g and water solubility index 31.30% respectively. The nutritional properties at optimum zone was protein 2.80%, fat 1.40%, ash 1.96%, carbohydrates 85.01%, fibers 1.20% and moisture content 6.0 % (db) respectively. The sensory score was highest at Arrowroot: Lesser yam: Potato (10:40:50) at 390 rpm screw speed and 130°C temperature. The sensory properties at the optimum zone i.e. appearance 7.5, colour 7.2, taste 8.5, texture 7.4, crispiness 7.0, expansion 7.3 and overall acceptability 7.5 respectively.

The extrudates prepared at optimum combination from (arrowroot (10%), lesser yam (40%) and potato (50%) with twin screw extruder at extrusion temperature 130°C, screw speed 390 rpm and 10% moisture (7ml water:3ml Kokum Liquid Concentrate)) were used for the packaging and storage study of the extrudates. The 60 g extrudates were packed in 3 types of packaging materials i.e. aluminium foil pouch (50 µ), polyethylene pouch (100 µ) and polyester pouch (40 µ) and stored at ambient temperature up to 60 days. Then stored samples were evaluated at interval of 0, 10, 20, 30, 40, 50 and 60 days for nutritional properties like protein, fat, fiber, ash, moisture, carbohydrates and functional properties like expansion ratio, bulk density, water absorption index, water solubility index, hardness in order to study the storage stability of the product. It was reveled that the there is no significant ($p \leq 0.01$) effect of packaging material and storage durations on nutritional and functional properties of stored extrudates. Among the packaging materials studied aluminium foil pouch (50 µ) was the best packaging material to store the extrudates up to 60 days. The change in nutritional properties of the extrudates over original properties at the 60 days period in aluminium foil pouch were protein 0.1 %, fat 0.18 %, fiber 0.14 %, ash 0.13 %, carbohydrates 1 % and moisture 0.83 %. The change in functional properties of the extrudates over the original properties at 60 days period packed in the aluminium foil pouch is expansion ratio 0.04, bulk density 0.06 g/cm^3, water absorption index 0.31 g/g, water solubility index 11.37 %, and hardness of extrudates 198 g respectively. Extrudates can be stored in good condition in aluminium foil pouch up to 2 months with better retention of nutritional and functional properties.

(Keywords: Arrowroot, Lesser yam, Potato, Drying of tuber crops, Extrusion cooking, Nutritional and functional properties, Tuber flour, extrudates, Sensory analysis, Optimization of extrudates, Packaging, Storage.)

No.	**:**	14
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Degree of which the thesis/project report submitted:	**:**	M.Tech.(PFE)
Year of Submission	**:**	2015-16
Name of the Guide/Co guide	**:**	Dr. S.P. Sonawane
Thesis Title	**:**	Dehydration Studies of Cashew Apple
Abstract	**:**	

In the present research work, physico-chemical properties of cashew apples (varieties Vengurla-4 and Vengurla-7) were evaluated for 5 days storage duration. The cashew apples were dried using tray drying process. Physico-chemical characteristics of dehydrated cashew apple and its powder were evaluated. Cashew apple slices (four equal slices), halves (two equal slices) and whole fruits of cashew apple were dried by tray drying methods at five levels of drying temperatures (50, 60, 70, 80 and 90^{o}C) and at constant air velocity of 2 m/s. Experiments were performed in Department of APE, College of Agricultural Engineering and Technology, Dapoli.

An attempt was made to evaluate drying characteristics of cashew apple (slices, halves & whole fruits) using tray drying method. Study of drying kinetics was done which include drying curves of moisture content versus time, drying rate versus moisture content and moisture ratio versus drying time. Time required for drying cashew apple slices was 26.5, 18, 14, 10.5 and 9 h at 50, 60, 70, 80 and 90^{o}C temperature respectively and similarly time required for drying halves was 32, 22.5, 16, 11.75 and 10 h at 50, 60, 70, 80 and 90^{o}C temperature respectively and whole fruits required about 34, 27.5, 22.75 and 19.25 h at 60, 70, 80 and 90^{o}C temperature respectively. The effect of drying temperature on shrinkage and colour was evaluated during the tray drying method. The drying of cashew apple slices at 50^{o}C temperature gives the minimum shrinkage and better retention of browning index.

Quality parameters for developed cashew apple powder such as particle size, colour, acidity, pH, TSS, total sugar, reducing sugar, non reducing sugar, protein, fibre, ash, vitamin C, water absorption capacity, oil absorption capacity etc. were evaluated. These quality parameters were evaluated for slices, halves and whole fruits powder at temperatures 50, 60, 70, 80 and 90^{o}C respectively. The cashew apple powder from cashew apple slices dried at 50^{o}C temperature was found to be better quality. This cashew apple powder had retained colour, acidity, pH, TSS and vitamin C, when compared with other powder.
Keywords: Cashew apple, tray drying, shrinkage, cashew apple powder, vitamin C.

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