



**DEPARTMENT OF
FOOD ENGINEERING
& TECHNOLOGY**

ABOUT THE DEPARTMENT



PROF. U. S. ANNAPURE

B. Tech., M.Sc. (Tech.), Ph.D. (Tech).

Professor of Food Technology and Head of Department

Food Engineering and Technology Department (FETD) have excellent achievements this year. During the year, 33 international research papers were published. Currently there are 55 PhD fellows and 50 M.Tech students working in the Department. It's a pride to note that, there was an excellent campus placement encompassing national, international and multinational companies.

The FETD was established in then UDCT in 1943 offering Bachelor of Science (Tech) in chemistry of foods and drugs. Later in 1949, a full-fledged B.Sc Tech. degree course in Food Technology was started. In 1963, again for the first time in the country, masters program in fermentation Technology was initiated and the department was christened 'Food and Fermentation Technology Department'. In the 21st Century, after aligning all the graduate programs as 12+ 4 pattern, the department has focused on engineering as well. To keep up with the present times, the course in fermentation technology has been restructured as food biotechnology.

VISION

"Establishing a center of excellence to provide demand driven, value-based and quality technical education to make India a developed country through socio-economic transformation"

MISSION

- To improve food, especially Indian traditional foods, in terms of nutrition, safety and functionality employing fundamental and applied sciences.
- To produce trained personnel of highest standards for the benefit of the industry and society, in the field of food engineering & technology and food biotechnology.
- To provide leadership in areas of education, research, innovations and solutions in food and biotech sciences, technology and engineering to direct overall activity towards economic growth of India.

**RESEARCH ACTIVITIES
AND INSTRUMENTAL
/ LAB FACILITIES
AVAILABLE :**

Major Research Interests

Thrust areas under CAS include – Carbohydrate Chemistry & Technology

- Cereal science & technology
- Chemistry & technology of traditional foods
- Enzymology, enzyme applications, modification of enzymes
- Food product / process development; instant food premixes
- Food quality analysis
- Fruits and vegetable processing
- Fermentation Technology & Food Biotechnology
- Fermented foods
- Fermentative production and downstream processing of enzymes / metabolites
- Nutraceuticals & natural pigments
- Nutrigenomics
- Plant tissue culture

**MAJOR INSTRUMENTAL
/ PROCESSING
FACILITIES**

Infrastructure

The FETD is well structured with equipments required for food processing that include extruders, retort processing unit, blast and fluidized freezer, pasta making machine, modified atmosphere packaging, dough sheeter, tray and IR dryer, fluidized bed dryer, fermentor, high pressure homogenizer,

ultrasonic processor, RO and ultrafiltration unit, spray dryer, supercritical extraction unit, and twin screw extruder.

The FETD also houses many analytical instruments such as HPLC, HPTLC, GC, GCMS, spectrophotometers, Hunter lab colorimeter, supercritical

carbon dioxide extraction unit, image analyzer, Brookfield rheometer, texturimeter, Haake viscometer, electrophoresis unit, protein purification system, PCR thermal cyclers, RT-PCR, and differential scanning calorimeter (DSC).

Sr. No.	Degree	Comments	No. of seats
1	B.Tech.(Food Engineering & Technology)	AICTE Approval in 2002 and later in 2008 (12 + 4) Pattern.	16
2	M.Tech.(Food Engineering & Technology)	AICTE Approval in 2008 and NBA accreditation in 2013	10
3	M.Tech.(Food Biotechnology) (Restructured Fermentation Technology course)	AICTE Approval in 2008.	10
6	Ph.D. (Tech.) (Food Engineering and Technology)	As per the availability of seats	
	Ph.D. (Tech) (Food Biotechnology)		
	Ph.D. (Tech) (Bioprocess Technology)		
	Ph.D. (Biotechnology)		
	Ph.D. (Biochemistry)		
	Ph.D. (Food Science)		

At Institute level

CURRENT STUDENTS :

Course	No. of Students	
	2016-17	2017-18
Masters (both years)	47[including 7 M.Tech (BPT)]	50[including 8 M.Tech (BPT)&1 M.Tech.(GT)]
Ph.D. (Tech) (all)	35	30
Ph.D. (Sci) (all)	29	25

DEGREES AWARDED DURING 2017-18

Name of Degree 5	No. of Students	
	2016-17	2017-18
B.Tech	16	14
M.Tech.	22[including 3 M.Tech (BPT)]	22[including 4 M.Tech (BPT)]
Ph.D. (Tech)	3	6
Ph.D. (Sci)	-	3

RESEARCH OUTPUT

		2016-17	2017-18
No. of Research Project	Govt.	3	6
	Private	4	6
No. of consultation Assignments		4	3
No. of Patents	Applied	-	-
	Obtained	-	-
No of Paper Published	National	-	-
	International	55+ 5 Book Chapters	33+3 Book Chapters+1 Review Paper
No. of Conference Presentations	National	10	6
	International	4	1
Citations*		>2830	> 2628

*from the google scholar for the calender year 2018

ANY OTHER INFORMATION

NBA accreditation has been received for the M.Tech degree course in Food Engineering and Technology. It is being awaited for the B.Tech degree course in Food Engineering and Technology and M.Tech degree course in Food Biotechnology.





PROFESSOR R. S. SINGHAL

B.Sc.(Hons.), M.Sc.(Tech.), Ph.D.(Tech.)

- Fellow, Maharashtra Academy of Sciences
- Fellow, Association of Food Scientists and Technologists (India)
- Fellow of the Biotech Research Society of India (BRSI)
- Dean, RCRM, ICT
- Professor of Food Technology

SUBJECTS TAUGHT

Food additives and ingredients, Current topics in food science and technology, Nutraceuticals and functional foods, Principles of food analysis, Modern techniques in food analysis, Food safety and toxicology

RESEARCH INTERESTS

Food quality, Food chemistry, Biopolymers, Lipid chemistry and technology, Food product development, Food processing, Fermentative production and downstream processing of biomolecules, Traditional foods.

Ph.D. (completed) – 31

Ph.D. (ongoing) – 17

Masters (completed) – 97

Masters (ongoing) – 7

Post-docs (completed) – 2

Post-docs (ongoing) – 3

PUBLICATIONS

International- 311

National- 9

Conference Proceedings – 140

Book chapters- 36

Patents (till date) - 1 granted and 2 applied

SPONSORED PROJECTS

Private – 5(completed)

Government – 4 (completed)

AWARDS/HONOURS:

National - 5

International - 1

H-INDEX: 57*

Citations: 13304

*As per google scholar on June, 2018

PROFESSIONAL ACTIVITIES

- Member, Editorial Board, Carbohydrate Polymers, Elseviers, UK
- Member, Selection committee for promotions, BARC, Mumbai.
- Member, Expert group in the area of secondary agriculture, Department of Biotechnology, Government of India.
- Member, Subject Expert Committee (SEC) on Engineering & Technology (ET), WOS-A scheme Department of Science and Technology, New Delhi.
- Member, Scientific panel of FSSAI, New Delhi, on i) Food Additives, Flavouring, processing Aids and Materials in Contact with Food, and ii) Water (including flavoured water) and beverages (alcoholic and non-alcoholic)
- Expert, UGC-DSA Programme, University of Mysore.
- Life Member, Association of Food Scientists and

Technologists (India).

- Life Member, Association of Carbohydrate Chemists and Technologists, India.
- Member, Advisory Board, Trends in Carbohydrate Research, published by ACCT (I).
- Member, BIPP, BIG, SBIRI, SPARSH and BIRAP, Department of Biotechnology, Government of India
- Referee, Several journals in food science and technology, and bioprocess technology
- Examiner, Ph.D thesis at some universities in India

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT

Professor Rekha Singhal has made outstanding contributions in the area of biopolymers in foods, in particular to polysaccharides and their modifications and their applications in the area of microencapsulation of numerous sensitive food constituents such as spice oleoresins, nutraceuticals and flavours. She successfully explored the use of indigenous raw materials for microencapsulation as an alternative to import substitutes;

to fermentative production and downstream processing of industrial biomolecules such as therapeutics (clavulanic acid, cyclosporin), nutraceuticals (lycopene, ubiquinone, zeaxanthin, gamma-linolenic acid), enzymes (glutaminase), polymers of varied industrial interest (polyglutamic acid, polylysine), and microbial polysaccharides (schizophyllan, curdlan, scleroglucan) among many others. Her work on supercritical carbon

dioxide extraction of food/pharmaceutical constituents and microbial metabolites is noteworthy. Besides, she has worked in frontier areas in food science and technology including traditional Indian foods with an aim to improving their quality and establishing the authenticity. In particular, her work on investigating acrylamide in traditional Indian foods was the first of its kind in the country and has received laurels. Her work on

hydrocolloids for reducing oil content of deep-fat fried foods attracted the food industry and catalyzed their acceptance as permitted additives by the legal authority in India (PFA). She has collaborated with scientists both in India (BARC, NIIST) and abroad (Aalto University, Finland; IIT Chicago) on topics of mutual interest such as food toxicology and biofuels, and has publications in standard journals based on the work undertaken.

TEN BEST REPRESENTATIVE PUBLICATIONS/PATENTS

Sr. No.	Title	Journal	Year, Vol.: Page No.	Journal impact factor (5 year)
01	Resistant starch-a review	Comprehensive Reviews in Food Science and Food Safety	2006, 5(1): 1-17	5.053
02	Glucose oxidase—An overview	Biotechnology Advances	2009, 27(4): 489-501	9.599
03	Microencapsulation of cardamom oleoresin: Evaluation of blends of gum Arabic, maltodextrin and a modified starch as wall material	Carbohydrate Polymers	2005, 61(1): 95-102	3.479
04	Starch-galactomannan interactions: Functionality and rheological aspects	Food Chemistry	1996, 55(3): 259-264	3.334
05	Comparison of artificial neural network (ANN) and response surface methodology (RSM) in fermentation media optimization: Case study of fermentative production of scleroglucan	Biochemical Engineering Journal	2008, 41(3): 266-273	2.579
06	Process optimization for the synthesis of octenyl succinyl derivative of waxy corn and amaranth starches	Carbohydrate Polymers	2006, 66(4): 521-527	3.479
07	Supercritical carbon dioxide extraction of cottonseed oil	Journal of Food Engineering	2007, 79(3): 892-898	2.276

08	Biosynthesis of silver nanoparticles using aqueous extract from the compactin producing fungal strain	Process Biochemistry	2009, 44(8): 939-943	2.414
09	Use of metabolic stimulators and inhibitors for enhanced production of β -carotene and lycopene by <i>Blakeslea trispora</i> NRRL 2895 and 2896	Bioresource Technology	2008, 99(8): 3166-3173	4.750
10	Carboxymethylcellulose and hydroxypropylmethylcellulose as additives in reduction of oil content in batter based deep-fat fried boondis	Carbohydrate Polymers	1996, 29:33- 35	3.479



PROFESSOR S. S. LELE

B.Chem.Engg. M.Chem.Engg., Ph.D. (Tech.)

Fellow, Maharashtra Academy of Sciences

Fellow, Biotech Research Society of India (BRSI)

Registrar & Professor of Biochemical Engineering

SUBJECTS TAUGHT

Food Engineering,
Fermentation Technology,
Fundamentals of Food Process
Engineering, Advances in Food
Engineering

RESEARCH INTERESTS

Food product/process
development, fruit and
vegetable based dehydrated
/ wet nutritious product
development, fruit wines
and biological effluent
treatments.

RESEARCH STUDENTS

Ph.D. (completed) – 27
Masters (completed) – 68
Ph.D. (ongoing) – 5
Masters (ongoing) – 6

RESEARCH PUBLICATIONS

International- 106
National- 8

Conference Proceedings – 27
Book / chapters – 5 chapters

PATENTS

02 (granted), 02 (applied)

SPONSORED PROJECTS

Government – 9(completed)
Ongoing- 3

AWARDS/HONOURS:

National – 12
International – 1

H-INDEX: 26*

citations: 3071

*As per google scholar on June
30, 2018

PROFESSIONAL ACTIVITIES

- Member, FIST program for science colleges, DST, 2017-2020
- ICT Coordinator, Unnat Bharat and Maharashtra Abhiyaan programme.

- Member, research recognition committee food science SNTD Mumbai.
- Member, Board of Governor, BRSI 2015-2017.
- Member, UGC expert advisory committee of SAP-UGC (Food Sci& Technology), Gurunanak dev university, Amritsar – 2013-18.
- Member, Examination Board, K J Somaiya College of Engineering, Somaiya Vidyavihar, Mumbai.
- Referee of several International Journals in Biotechnology and Food Engineering.
- Life member of a number of national and international professional bodies engaged

in activities related to Science & Technology and Women Scientists, AFST, AMI, BRSI, IChE, UAA.

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT

Prof. S.S. Lele is a dynamic personality with an exceptional career in research as well as academic administration. She is well known for her outstanding contribution to the field of food technology-engineering for the last four decades. She is actively involved in research and translation and is responsible for the conception and successful operation of several food processing start-ups. She has published over 100 international papers in refereed journals and has 2 patents granted to her credit. What sets her apart is her constant endeavor to serve society through science and technology. She has been an active life member of AFST (I) and was elected as President of AFST (I), Mumbai Chapter (2011-13).

Mentoring students for personality development, career planning and developing interest in science is her favorite activity. She has been taking sessions on these topics across the country. In addition, she single handedly organized National Science Day on 28th Feb every year in UDCT (ICT) since 1993 to 2008 for high school and college students. She must have influenced thousands of students and guided them for appropriate selection of career at crucial time in their life.

Yet another sector of the society for which Dr. Smita

Lele has devoted significant time in last 40 years is helping house wives to save energy and retain nutrition in the kitchen, developing scientific temper in life, awareness on right food, nutrition and positive attitude. Periodical writing, talks, interviews, counselling and many more tools were used for this. Her books and videos, radio talks and TV interviews on these topics must have touched millions of souls and improved their day to day life, health and profession as well.

Especially in last two decades, Prof. Lele has been working in the field of developing fruit and vegetable “processes and products” as her research theme. While working on fundamental science to train the students, the focus was also on solving grass root problems which resulted into commercially successful endeavors. During this, over 100 research students were trained as problem solvers and some also developed entrepreneurship spirit and have started their own processing units. In addition, in last 10 years Prof. Lele has singlehandedly conducted about 10 hands on trainings on the various food processing technologies (dehydration, retorting, non-grape wine making etc.) where approximate 650 persons are trained on food processing (dehydration, retort processing, fruit wine making etc.)

Prof. Lele’s goal is to uplift farmers with a 4-Win approach for all stake holders – farmer, processor, consumer, society. She has initiated a positive

agreement with farmers allowing them to sell in open market if price rises. For example, backward integration of nearly 120 farmers in vicinity of Satara area has increased the farmers’ income to Rs 2 lakh per year per acre from a meagre figure of only Rs. 30,000 PA. The agreement is signed with the farmers in a positive manner where assured price for fresh produce is committed but in case the market rate rises, the farmers are free to go to the market and sell their crop at higher rate. Yet the processing Unit sustains due to multipurpose multi product processes developed. A few start up units have been set up in remote areas of Maharashtra (Western Ghats and Konkan Region) where livelihood is generated for the rural population. The retort product plant is capable of making 6 tons wet product (RTE) and drying unit makes 4 tons dry flex and the plant has reached break even in 4 years. Unique products (local traditional leafy vegetables like arvi) and healthy and home style products like moon dal khichadi are very popular. Some of the retort products have been approved by the Indian Army due to the high quality, home-like taste and absence of preservatives.

After successful mentorship of the Startup at Satara (Trilok Food) for wet and dry vegetable products, Dr. Smita received State Govt. Grant to help small farmers from Konkan area to make value added products from local fruits. She has developed non grape fruit wine technology and again mentor a

startup “Sawarde Valley Food Foundation”, SVFF a Section 8 nonprofit company, located in Chiplun, Ratnagiri. The frutine brand is established and especially Jamun wine is appreciated due to its health benefits for diabetics. Other fruits like mango, kokum, and jackfruit are also used. It is the

first commercial attempt of its kind in the nation. The project is economically sustainable if only 20,000 liters of fruit wine is made in a year.

In Dec 2015, Prof. S.S. Lele, Registrar, ICT was awarded the UDCT Alumni Association’s distinguished alumni award under Academics. Prof. Lele

received the “**Uncha Maza Zoka**” Zee Marathi National Award in 2016. She was felicitated at the hands of Padma Vibhushan Dr. Anil Kakodkar for her outstanding contributions in the field of fruit and vegetable processing in Maharashtra.

TEN BEST REPRESENTATIVE PUBLICATIONS/PATENTS

Sr. No.	Title	Name of the Journal	Year, Vol.: page no.	Journal impact factor (5 year)
1	Kinetic modeling and implementation of superior process strategies for beta-galactosidase production during submerged fermentation in a stirred tank bioreactor.	Biochemical Engineering Journal	(2013). 77 49– 57	2.984
2	Use of a batch-stirred reactor to rationally tailor biocatalytic polytransesterification.	Biotechnology and Bioengineering	(2000) 67 (4): 424-434.	3.648
3	Modelling of air-lift fluidized bed: Optimization of mass transfer with respect to design and operational parameters	Chemical Engineering Journal	(1992) 49 (2): 89-105	3.691
4	Three Phase Partitioning of β -galactosidase produced by an indigenous <i>Lactobacillus acidophilus</i> isolate	Separation and Purification Technology	(2013). 110 (2013). 44–50	3.525
5	Synthetic dye decolorization by white rot fungus, <i>Ganoderma</i> sp.	Bioresource Technology	(2007) 98 (4): 775-780.	5.172
6	Kinetic and equilibrium modeling of chromium (VI) biosorption on fresh and spent <i>Spirulina platensis</i> / <i>Chlorella vulgaris</i> biomass.	Bioresource Technology	(2008) 99 (9): 3600-3608.	5.172
7	Simultaneous removal of carbon and nitrate in an airlift bioreactor	Bioresource Technology	(2009). 100 (3): 1082-1086.	5.172
8	Application of response surface methodology to cell immobilization for the production of palatinose	Bioresource Technology	(2007). 98 (15): 2892-2896.	5.172
9	Denitrification of high strength nitrate waste.	Bioresource Technology	(2007) 98 (2): 247-252.	5.172
10	Phase transfer catalysis in extraction accompanied by fast reaction in diffusion film	Chemical Engineering Science	(1981) 36: 955 - 956	2.653



DR. U. S. ANNAPURE

B. Tech., M.Sc. (Tech.), Ph.D. (Tech).

Professor of Food Technology and HOD

SUBJECTS TAUGHT

Food Chemistry, Principles of food Preservation, Technology of Fruits, Vegetables and Tubers, Current topics in Food Science and Technology, Microbiology Lab, Carbohydrate Chemistry and Technology

RESEARCH INTERESTS

Cold Plasma Technology for Food Processing, Extrusion processing – process and product Development, Frying - Chemistry and Technology, Nutraceuticals – Chemistry, Technology and Product Development, Carbohydrates – Chemistry and technology of minor grains, tubers and plant gums, Traditional foods - Product and technology development, Enzyme applications in food processing, Downstream processing-enzymes, antioxidants, and biomolecules

RESEARCH STUDENTS

Ph.D. (completed). – 10
Masters (completed) – 58
Ph.D. (ongoing) – 14
Masters (ongoing) – 11

RESEARCH PUBLICATIONS

International- 77 International (this year)-7
National- 9
Conference Proceedings – 72
Patents- 3
Book Chapter – 3

SPONSORED PROJECTS

Government – 2 (completed)
Government – 1 (ongoing)
Private – 2 (completed)
Private – 1 (ongoing)

AWARDS/HONOURS

National - 01

H-INDEX: 20

citations: 1200

*As per google scholar on June, 2018

PROFESSIONAL ACTIVITIES

- Vice President of AFST (I), Mumbai Chapter 2016-17.
- Member, Board of Studies (BoS) for M.Sc. Food Technology at Defence Institute of Advanced Technology (Deemed University), Pune.
- Member, Research and Recognition Committee in subject of food science and technology at Shivaji university Kolhapur, 2017-18
- Member, selection committee for promotion under CAS, Dr. Babasaheb Ambedkar marathwada university.
- Member, selection committee for promotion under CAS at North Maharashtra university, jalgaon.

- Member, RRC in subject of chemical technology (food) at Dr. Babasaheb Ambedkar marathwada university.
- Member, Research advisory committee, Indian Institute of food processing Technology (IIFPT, Tanjavur).
- Referee, for various national and international journal in the area of food science and technology.
- Examiner for Ph.D thesis of various universities in India.
- Member, food additives sectional committee (FAD 8) at BUREAU of Indian standard New Delhi.
- Member, National Core group for broad subject matter area (BSMA), Indian council for education research (ICAR), New Delhi.
- Member, committee for scrutinizing minor research proposal at Mumbai university
- Member, Selection committee for appointments of Assistant Professor at Shivaji University Kolhapur.
- Life Member, Association of Food Scientists and Technologists, India [(AFST (I)].
- Life Member, Association of Carbohydrate Chemists

and Technologists of India (ACCTI).

- Life Member, Biotech Research Society of India (BRSI).
- Member, International Society of Food Engineering (ISFE), USA.
- Life Member, UDCT Alumni Association.

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT

Cold plasma can be used as a non-thermal process which is capable of surface modification and surface sterilization. The

plasma processing of food grains may lead to changes in surface morphology. The objectives of these studies may include but not limited to study the physico-chemical changes occur during plasma treatment and their impact on overall quality of the grains.

Extrusion is being commonly used for manufacture of snack foods. The process is well studied with the common cereals and few legumes as a raw material. In our laboratory the focus is on the possible utilization of indigenous grains and legumes so that the locally

available raw material can be utilized for extrusion as well as there will be value addition to these indigenous grains.

Gums are being commonly used in food systems as stabilizers, viscosity and texture modifying agents. Few plant gums are well established for their food applications but our focus is to identify and explore the edible gums from lesser known indigenous plants. The isolated gums will be studied for their characteristics includes but not limited to viscosity, rheological properties and food applications.

TEN BEST REPRESENTATIVE PUBLICATIONS/PATENTS

Sr. No.	Title	Journal	Year, Vol.: Page no.	Journal impact factor (5 year)
1	Plasma activated water (PAW): Chemistry, physico-chemical properties, applications in food and agriculture	Trends in Food Science & Technology	2018, 77, 21-31	6.6
2	Physicochemical, functional and rheological investigation of Soymidafebrifuga exudate gum	International Journal of Biological Macromolecules	2018, 111, 1116-1123	3.92
3	Influence of cold plasma on fungal growth and aflatoxins production on groundnuts	Food Control	2017, 77, 187-191	3.67
4	Comparative study of Acacia nilotica exudate gum and acacia gum	International Journal of Biological Macromolecules	2017, 102, 266-271	3.92
5	Functional and rheological properties of cold plasma treated rice starch	Carbohydrate Polymers	2017, 157, 1723-1731	5.11
6	Cyclosporin A — A review on fermentative production, downstream processing and pharmacological applications	Biotechnology Advances	2011, 29 418-435	11.85
7	Acrylamide content in fried chips prepared from irradiated and non-irradiated stored potatoes	Food Chemistry	2011, 127 (4), 1668-1672	4.9

8	Effect of damaged starch on acrylamide formation in whole wheat flour based Indian traditional staples, chapattis and pooris	Food Chemistry	2010, 120(3), 805-809	4.9
9	Effect of an alkaline salt (papadkhar) and its substitute (2:1 sodium carbonate:sodiumbicarbonate) on acrylamide formation in papads	Food Chemistry	2009, 113(4), 1165-1168	4.9
10	Response surface methodology in media optimization for production of β -carotene from <i>Daucus carota</i> .	Plant Cell, Tissue and Organ Culture	2008, 93:123-132	3.663



DR. LAXMI ANANTHANARAYAN

B.Sc. (Hons.), B.Sc. (Tech), M.Sc. (Tech.), Ph.D. (Tech.)

Associate Professor, Coordinator M Tech (Food Biotechnology)

SUBJECTS TAUGHT

Chemistry of food constituents, Nutrition, Food Packaging, Current topics in Food Science and Technology, Principles of Food preservation, Food Biotechnology lab, Basics of Human Nutrition, Advances in nutrition, Enzymes in the food industry

RESEARCH INTERESTS

Traditional Foods, Fermented foods, Low GI foods, Fruit and vegetable processing, CAP/MAP technology, Extrusion technology, Protein purification, Enzymology, Nutraceuticals/ health beneficial phytoconstituents, Natural pigments, Microbial metabolites, Bioactive peptides, protein hydrolysates, Novel methods of food processing and preservation such as ultrasonication and

edible coating, plant based enzymes, development of novel nutritional products, Food adulteration/ contamination/ authentication/ allergenicity testing by proteomics, problems of small scale food industries, food safety and quality

RESEARCH STUDENTS

Ph.D. (ongoing) – 13
(+02 Co-guide)
Masters (completed) – 77
Ph.D. (Completed) – 05
Masters (ongoing) – 6

RESEARCH PUBLICATIONS

International- 44
International (this year)-04
National - 01
Peer-reviewed-33
Book / chapters- 01

H-INDEX: 15
citations: 2491

*As per google scholar on June, 2018

PROFESSIONAL ACTIVITIES

- Life Member, Association of Food Scientists and Technologists (India).
- Life Member, UDCT Alumni Association.
- Member of Board of studies of Biotechnology Department of SIES College, Mumbai.

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT

Dr. Laxmi Ananthanarayan has carried out extensive research on varied topics of food science and technology, bioprocess technology, food biotechnology and biochemistry. She has worked in the area of traditional

foods, fermented foods, foods with improved nutritional properties, functional foods, healthy snacks, extruded foods, etc. Her work on prevention of staling in chapatti has been widely recognized and referred to by small scale manufacturers while her work on idli batter stabilization and preservation has also attracted the attention of producers in this sector. She has also explored various nutritional aspects of foods such as bioactive peptides, legume

based allergens, isoflavones from legume sources and nutraceutical rich ingredients. She has investigated the exploitation of novel methods of food processing for food preservation such as edible coatings, ultrasonication, MAP etc. She has shown interest in developing methods for detection of food adulteration based on proteomics and has undertaken research in the area of food safety. She has also undertaken research in

the area of characterization and deactivation of fruit based enzymes and enzyme inhibitors. Natural plant based sources of pigments and plant based enzyme activities are also topics of research interest for her. Dr. Laxmi has undertaken extensive research in exploring the production, purification and characterization of various microbial metabolites such as enzymes, pigments and antimicrobials.

TEN BEST REPRESENTATIVE PUBLICATIONS/PATENTS

Sr. No.	Title	Name of the Journal	Year, Vol.: Page no.	Journal impact factor (5 year)
1	Effect of extrusion process parameters and pregelatinized rice flour on physicochemical properties of ready-to-eat expanded snacks	Journal of Food Science and Technology	2014, Article in Press	1.123
2	Characterization and in vitro probiotic evaluation of lactic acid bacteria isolated from idli batter	Journal of Food Science and Technology	2013, 50(6): 1114-1121	1.123
3	Identification of putative and potential cross-reactive chickpea (<i>Cicer arietinum</i>) allergens through an in silico approach	Computational Biology and Chemistry	2013, 47: 149- 155	1.596
4	Co-immobilization of glucose oxidase-catalase: Optimization of immobilization parameters to improve the immobilization yield	International Journal of Food Engineering	2011, 7(2):8	2.927
5	Purification of a bifunctional amylase/protease inhibitor from ragi (<i>Eleusine coracana</i>) by chromatography and its use as an affinity ligand	Journal of Chromatography B: Analytical Technologies in the Biomedical and Life Sciences	2010, 878 (19): 1549-1554	2.9
6	Purification of lycopene by reverse phase chromatography	Food and Bioprocess Technology	2009, 2(4): 391-399	4.115

7	Optimization of <i>Aspergillus niger</i> fermentation for the production of glucose oxidase	Food and Bioprocess Technology	2009, 2(4): 344-352	4.115
8	Glucose oxidase - An overview	Biotechnology Advances	2009, 27(4):489-501	11.85
9	Enzyme stability and stabilization Aqueous and non-aqueous environment	Process Biochemistry	2008, 43(10):1019- 1032	2.983
10	Effect of α -amylase addition on fermentation of idli-A popular south Indian cereal-Legume-based snack food	LWT - Food Science and Technology	2008, 41(6):1053-1059	3.107



DR. S. S. Arya

B.Tech., M. Tech, Ph. D (Tech.)

Assistant Professor of Food Technology

SUBJECTS TAUGHT

Technology of cereals, legumes and oilseeds, Food microbiology, Technology of plantation crop, Current topics in food science and technology, Basics of food science and technology, Advances in food biotechnology and genetics, Food processing (I), Food analysis (Chemical), Technical analysis-I,II, Food technology laboratory

RESEARCH INTERESTS

Cereal chemistry and processing - process and product development, Indian Traditional foods - chemistry, technology and product development, Nutraceuticals - chemistry, technology and product development, Cereal legume health products - low glycemic index foods, gluten free formulations, utilization of food waste, Fermented indigenous

foods, Downstream processing of biomolecules.

RESEARCH STUDENTS

Ph.D. (ongoing) - 05
Ph.D. (Completed) - 01
Masters (completed) - 28
Masters (ongoing) - 07

RESEARCH PUBLICATIONS

International - 42
International (this year)-08
National- 05
Conference Proceedings - 32
Book / Monograph- 2

SPONSORED PROJECTS

Government -3 (Completed)
Government -1 (Ongoing)
Private -3 (Completed)
Private -5 (ongoing)

H-INDEX: 12

citations: 527

*As per google scholar on June 2018

PROFESSIONAL ACTIVITIES

- Member, Global Young

Academy, Halle, Germany, 2018

- Local Executive Committee Member, Association of Food Scientists and Technologists (I), Mumbai Chapter
- Life Member, Biotechnology Research Society of India (BRSI), India.
- Life Member, Association of Carbohydrate Chemists and Technologists of India.
- Member, Society of Chemical Industry (SCI), London.
- Member, International Society of Food Engineering (ISFE), Pullman, USA.
- Member, CFT-PBN Alumni Association (CPAA), Mumbai

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT

Dr. Shalini Arya works in the area of Indian traditional foods, in particular cereal based staple foods such as chapatti, phulka, thepla, khakhara, thalipeeth, naan and kulcha. Her work is focused on various aspects such as product development and standardisation, nutritional improvement and characterisation, chemistry and technology, staling, extension of shelf life using various technologies (MAP, oxygen scavenger, chemical, freezing etc) for these products, all of which would have far reaching significance in improving public

health in India and that too based on the resources that are locally available and food staples that are regularly consumed by the locals.

Her work on chapatti was recognised during international and national conferences and was awarded with first prize under cereal category. She also works on utilisation of food industry waste into value added products, bioactive peptides from underutilised plant seeds, development of low glycemic index foods, functional food products from peanuts and quality improvement of gluten free flat bread.

India unfortunately becoming capital country for diabetes

and cardiovascular affected population and thus developing cost effective product technologies is very necessary. Dr Shalini and her research group have developed Indian traditional food products having low glycaemic index using low cost and locally available ingredients. In addition to this Dr. Shalini has been helping multinational food industries for developing traditional food product technologies for e.g. chapatti, paratha, bhaji, instant food mixes. She has helped industries for developing low glycaemic index formulation, high soluble fiber paratha premisses, high protein atta premix and other healthy low cost nutritious premisses.

TEN BEST REPRESENTATIVE PUBLICATIONS/PATENTS

Sr. No.	Title	Name of the Journal	Year, Vol.: page no.	Journal impact factor (5 year)
1	Effect of flaxseed flour addition on physicochemical and sensory properties of functional bread	LWT- Food Science and Technology	2014, 5 (2): 614–619	3.107
2	Effect of drying and storage on bioactive components of jambhul and wood apple	Journal of Food Science and Technology	201452(5), pp. 2833-2841	1.123
3	Use of fruits by-products in the preparation of hypoglycaemic thepla-Indian unleavened vegetable flat bread	Journal of Food Processing and Preservation	2014, 38 :1198–1206	0.450
4	Effect of guar gum on dough stickiness and staling in chapatti–an Indian unleavened flat bread	International Journal of Food Engineering	2009, 5 (3) :1-19	0.463
5	Use of response surface methodology to investigate the effects of milling conditions on damaged starch, dough stickiness and chapatti quality	Food Chemistry	2009, 112 (4): 1010-1015	3.334

6	Inhibition of staling in chapatti (Indian unleavened flat bread)	Journal of Food Processing and Preservation	2008, 32(3): 378-403	0.450
7	Influence of additives on rheological characteristics of whole wheat dough and quality of chapatti (Indian unleavened flat bread) part I- hydrocolloids	Food Hydrocolloids	2007, 21: 110-117	3.525
8	Staling of chapatti (Indian unleavened flat bread)	Food Chemistry	2007,101: 113-119	3.334
9	Role of novel nanomaterials in solving food safety issues	European Journal of Nutrition & Food Safety	2014, 4(4): 301-317.	-



DR. JYOTI S. GOKHALE

B.Pharm., M. Tech, Ph. D (Tech.)

UGC Assistant Professor

SUBJECTS TAUGHT

Principles of Food Analysis, Biotechnology of Fermented Foods, Waste Management in Food Processing, Nutraceuticals and Functional Foods, Biochemistry Lab, Technical Analysis Lab

RESEARCH INTERESTS

Food Biotechnology, Bioprocess Technology, Waste Management, Fermentation Technology

RESEARCH STUDENTS

Masters (completed) – 4
Masters (ongoing) – 4
Publications
International- 6 Book Chapter
- 01
Conference Proceedings – 1

H-INDEX: 4*

citations: 65

*As per Scopus on June 5, 2018

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT

Chirality is a ubiquitous concept in nature. It is of utmost importance in drug synthesis and is a key factor in the safety and efficacy of many drug products and thus the production of single enantiomers of drug intermediates has become increasingly important in the pharmaceutical industry. Chiral drugs continue to be a significant force in the global pharmaceutical market. About one third of all medicinal drugs are chiral. The current work was centered on the use of enzymes in non-aqueous media to synthesize enantiomerically pure products of commercial value in pharmaceutical and fine chemical industry. The kinetic

modeling was also considered in each case.

Reaction schemes are as follows:

- (1) Kinetic resolution of (\pm)-1-phenylethanol using vinyl acetate as an acyl donor over immobilized *Candida antarctica* lipase
- (2) Microwave irradiated enantioselective acylation of (\pm)-1-phenylethylamine using ethyl acetate as an acyl donor
- (3) Kinetic resolution of 2-pentanol, an antialzheimer's drug, using vinyl acetate as an acyl donor
- (4) Enantioselective acylation of 2-octanol with vinyl acetate as an acyl donor using Novozyme 435

Research at University of Saskatchewan, Canada

(1) Characterization of waste pinewood and its conversion into bio-oil under supercritical water

In the present work, mountain pine beetle infested pine wood has been used as a feedstock for biofuel production under supercritical water. Biomass has been characterized with different techniques such as FTIR, Ash content, volatile matter content, XRD and determination of extractives. Bio-oil thus produced under hydrothermal treatment has been characterized using different analytical techniques such as FTIR, NMR and GCMS. HMF was found to be the major component of bio-oil,

which can be converted to 2,5-dimethyl furan, which is a liquid fuel, in certain ways superior to ethanol.

(2) Optimization of lipase catalyzed biodiesel production from canola oil using response surface methodology

Research work done during M. Tech. Bioprocess Technology

Nowadays, lipases are used as a routine tool for the preparation of pharmaceutical drugs and drug intermediates. Esterification of p-amino phenyl acetic acid was carried out using different lipases, amongst which Novozyme 435 was found to be the most active catalyst to produce ethyl p- amino phenyl acetate,

which is a drug intermediate of an antiarthritic drug, Actarit. The effects of various parameters on the conversion and the rates of the reaction were studied in the presence of Novozyme 435 with toluene as a solvent under microwave irradiation. Both the initial rate data and the progress curve analysis were used to arrive at the ping pong bi bi mechanism with inhibition by p-amino phenyl acetic acid. The model fits the initial rate data very well. This work has shown that ethyl p- amino phenyl acetate, a drug intermediate of actarit, can be synthesized by lipase catalyzed esterification reaction in toluene as a solvent.

TEN BEST REPRESENTATIVE PUBLICATIONS/PATENTS

Sr. No.	Title	Name of the Journal	Year, Vol.: page no.	Journal impact factor (5 year)
1	Optimization and kinetic modeling of lipase catalyzed enantioselective N-acetylation of (\pm)-1-phenylethylamine under microwaves irradiation	Journal of Chemical Technology and Biotechnology	2011, 86(5), 739-748	2.738
2	Kinetic modeling and Statistical Optimization of Lipase Catalyzed Enantioselective resolution of (RS)-2-pentanol	Industry Engineering and Chemistry Research	2011, 50, 12975-12983	2.98
3	Optimization of Chiral Resolution of (R,S)-1-Phenylethanol by Statistical Methods	International Journal of Chemical Reactor Engineering	2011, 9, A77, 1-15	0.759
4	Optimization and kinetic modeling of lipase catalyzed chiral resolution of 2-octanol in non-aqueous media	Natural Science	2013, 5(9), 1025-1033	0.52

5	Microwave Assisted Synthesis of Ethyl 2-(4-aminophenyl) Acetate using Novozyme 435	Current Catalysis	2014, 3, 27-34	2.64
6	Methods for Separation and Recycling of Biodegradation Products	Biodegradation/ Book 1	InTech, ISBN: 980-953-307-968-9	--
7	Viridiplantae: Holistic Approach for Food Security and Environmental Protection in Indian Scenario	Environmental Science and Engineering	Vol 5: Municipal Solid Waste, Pg 290-308	--



DR. Snehasis Chakraborty

B.sc., B.Tech., M. Tech, Ph. D (Food Process Engg.)

Assistant Professor, Food Technology

SUBJECTS TAUGHT

Food engineering, advances in food engineering, current topics in food science and technology and technology of plantation crops food analysis lab, food processing lab I

RESEARCH INTERESTS

Food Process Engineering, Nonthermal processing of food, Kinetics modeling, Shelf-life extension, Sensory analysis, Process optimization

RESEARCH STUDENTS

Ph.D. (ongoing) – 01
Masters (ongoing) – 06
Masters (completed) – 03

RESEARCH PUBLICATIONS

International - 19
International (this year)- 03
Book / Monograph- 4
Book chapter: 4
Peer-reviewed-6

H-INDEX: 7*

citations: 220* As per Scopus on June, 2018

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT

Dr. Snehasis Chakraborty is working as an Assistant Professor in Department of Food Engineering and Technology, Institute of Chemical Technology, Mumbai since October 2015. Dr. Snehasis Chakraborty is a young academician working on processing of fruit beverages and mathematical modelling of food quality parameters affected by processing parameters. He was the Institute Silver Medalist and Departmental topper in Department of Agricultural & Food Engineering, IIT Kharagpur during his master's in Food Process Engineering. He had hands on experience on processing of fruit beverages

at Germany through DAAD Fellowship. His PhD thesis on high pressure processing of pineapple puree conducted at IIT Kharagpur received the Jawaharlal Nehru Outstanding Thesis 2017 by ICAR, India. He has published 20 referred research papers, one book, 6 book chapters. He served as an expert reviewer in National Science Centre (Narodowe Centrum Nauki - NCN), Poland. In addition, he also served as an expert reviewer of international journals from Elsevier, Springer and Wiley. His research area focusses on nonthermal processing of food. His research team basically focus on developing fruit beverages and the kinetic modeling under different treatment conditions like thermal treatment and pulsed light processing.

TEN BEST REPRESENTATIVE PUBLICATIONS/PATENTS

Sr. No	Author	Title	Journal	Vol	Page	Year	Impact Factor
1	Chakraborty, S., Kaushik, N., Rao, P.S., & Mishra, H.N.	High-pressure inactivation of enzymes: A review on its recent applications on fruit purees and juices.	Comprehensive Reviews in Food Science and Food Safety	13(4)	578-596	2014	4.903
2	Chakraborty, S., Baier, D., Knorr, D., & Mishra, H.N.	High pressure inactivation of polygalacturonase, pectinmethylesterase and polyphenoloxidase in strawberry puree mixed with sugar.	Journal of Food and Bioproducts Processing	95	281-291	2015	2.687
3	Chakraborty, S., Rao, P.S., & Mishra, H.N.	Kinetic modeling of polyphenoloxidase and peroxidase inactivation in pineapple (<i>Ananascomosus</i> L.) puree during high pressure and thermal treatments.	Innovative Food Science and Emerging Technologies	27	57-68	2015	2.997
4	Chakraborty, S., Rao, P.S., & Mishra, H.N.	Effect of combined high pressure-temperature treatments on color and nutritional quality attributes of pineapple (<i>Ananascomosus</i> L.) puree	Innovative Food Science and Emerging Technologies	28	10-21	2015	2.997
5	Chakraborty, S., Rao, P. S., & Mishra, H. N.	Response surface optimization of process parameters and fuzzy analysis of sensory data of high pressure-temperature treated pineapple puree.	Journal of Food Science	80(8)	E1763 - E1775	2015	1.649

6	Chakraborty, S., Rao, P.S., & Mishra, H.N.	Empirical model based on Weibull distribution describing the destruction kinetics of natural microbiota in pineapple (<i>AnanascomosusL.</i>) puree during high-pressure processing.	International Journal of Food Microbiology	211	117-127	2015	3.445
7	Jayachandran, L. E., Chakraborty, S., & Rao, P. S.	Effect of High Pressure Processing on Physicochemical Properties and Bioactive Compounds in Litchi based Mixed Fruit Beverage	Innovative Food Science & Emerging Technologies	28	1-9	2015	2.997
8	Chakraborty, S., Rao, P.S., & Mishra, H.N.	Changes in quality attributes of high pressure and thermally processed pineapple (<i>AnanascomosusL.</i>) puree during storage	Food and Bioprocess Technology	9(5)	768-791	2016	2.574
9	Chakraborty, S., Rao, P.S., & Mishra, H.N.	Modeling the inactivation kinetics of fruit bromelain in pineapple during high-pressure and thermal treatments	Innovative Food Science and Emerging Technologies	33	10-18	2016	2.997
10	Jayachandran, L. E., Chakraborty, S., & Rao, P. S.	Inactivation kinetics of the most baro-resistant enzyme in high pressure processed litchi based mixed fruit beverage	Food and Bioprocess Technology	9(7)	1135-1147	2016	2.574

VISITING FACULTY

B.TECH (FOOD ENGINEERING AND TECHNOLOGY)

- Dr. Jayant R. Bandekar, D 1801,Runwal Center, Opp. ICICI Bank, Deonar, Mumbai – 400 088.
- Dr. Shruti Baadkar, 259/10187, Sagar-Sangeet,

Kannamwar nagar-1, Vikhroli (E), Mumbai – 400 083

- Dr. Subha Nishtala, F-102, Oberoi Splendor, JVLR, Andheri (E), Mumbai – 400 060.
- Dr. Shyam Asolkar, Prof. Indian Institute of Technology, CEST, Powai, Mumbai – 400076.

- Dr. Hormaz Patwa, Technical Executive, Sensient India Pvt. Ltd., Powai, Mumbai.
- Ms. Swati Deodhar Singh, c/o Sonia Kharapurkar, Flat No. 402, Aakash Building, Vishnu Nagar, Naupada, Thane (W) – 400 602

M.TECH. (FOOD ENGINEERING AND TECHNOLOGY) AND (FOOD BIOTECHNOLOGY)

- Dr. Jayant R. Bandekar, D 1801, Runwal Center, Opp. ICICI Bank, Deonar, Mumbai – 400 088.
- Dr. Subha Nishtala, F-102, Oberoi Splendor, JVLR, Andheri (E), Mumbai – 400 060.
- Dr. Joseph I Lewis, C-602, Vastu Park, Malad West, Mumbai.
- Dr. Rohit Upadhyay, Bldg., No.1, B wing, 2nd floor, Unit No. 203, Kailas Industrial complex, Park Site, Vikroli (W), Mumbai-400079
- Dr. Lambert Rodriguez, 203, Hrushikesh , B Bulding, A wing, Apna ghar, Andheri (W), Mumbai – 400 053
- Dr. Veena Yardi, Associate Professor, College of Home Science, Nirmala Niketan, Mumbai
- Dr. Shruti Baadkar, 259/10187, Sagar-Sangeet, Kannamwar nagar-1, Vikhroli (E), Mumbai – 400 083
- Dr. Shantanu Samant, Thane Technical centre, Mondelez India foods Pvt. Ltd. Off. Eastern express Highway, 1st Pokhran Road, thane (W), - 400 606

SUPPORT STAFF



Mrs. Sagarika S. Jadhav
Laboratory Technician



Ms. Sangita R. Dhakne
Laboratory Assistant



Mr. Chitra B. Koli
Laboratory Assistant



Mr. Shashikant Magdum
Laboratory Assistant



Mr. Ganesh S. Bhagat
Laboratory Attendant



Mr. Santosh J. Rajam
Laboratory Attendant



Mrs. Pramila P. Pawar
Laboratory Attendant



Mr. Rupesh Alim
Laboratory Attendant

MAJOR AWARDS / HONOURS

- Dr. Snehasis Chakraborty Received DAAD Fellowship under Re-invitation program of former DAAD scholarship holders in MAY 2018.
- Dr. Snehasis Chakraborty Received Professor D.V. Rege-AFST Mumbai Chapter-2011 Endowment for Best Teacher Award 2018.
- Dr. Shalini S. Arya Received best paper award for the work “Hydrodynamic cavitation for energy efficient and scalable process of microalgae cell disruption” Elsevier, Miami, Florida, USA, 2017.
- Dr. L. Ananthnarayan Won second prize in ‘DuPont NutriScholars Awards’ under the category of ‘Most Nutritious Food Idea’ in December 2017.

UNDERGRADUATE AND POSTGRADUATE SEMINARS & PROJECTS

As a part of the curriculum, every student of final year B.Tech student and first year M.Tech student presents a specific technical topic and submits a written review in the form of a seminar. The faculty members of FETD actively participate in guiding the undergraduate (B. Tech.) and postgraduate (M. Tech.) students for their seminars, project reports and other curricular activities which are tabulated below:

(* Indicates women student)

Sr. No.	Student	Title	Guide
B. TECH. (FOOD ENGINEERING & TECHNOLOGY) SEMINARS			
1.	Ashishkumar Darji	Morinda citrifolia: Nutritional health benefits and novel food applications	S.S.Arya
2.	Chinmay Kinage	Microwave assisted sterilisation of foods: Opportunities and Challenges	J.S.Gokhale
3.	Ruchir Agrawal	Newer sources of pectin: extraction, characterisation and applications	R.S.Singhal
4.	Noopur Mehta	Probiotic fruit beverages	S.S. Lele
5.	Meenakshi Gupta	Novel shelf life extension technologies of fresh cut fruits and vegetables	U.S.Annapure
6.	Manish Chauhan	Minor millets: Chemistry, technology and nutritional health benefits	S.S. Arya
7.	Shubham Sawardekar	Enzymatic production, purification and application of lactulose	J.S. Gokhale
8.	Vaishnavi Patki	Application of MRI technique in food processing	S. Chakraborty
9.	Vaidehi Narkar	Dietary fibres for making high fibre food products	J.S. Gokhale
10.	Shubham Purandare	Resistant starch: updates on production, health benefits and novel applications	S.S. Arya
11.	Gautamraj Dadlani	Carbon footprint in food beverage industry	S. Chakraborty
12.	Rohit Jorigal	Recent developments in stabilisation of natural pigments for food applications	L. Ananthnarayan
13.	Pranav Raval	Nutraceuticals- Key concepts and future prospects	U.S.Annapure
14.	Yash Kakani	Collagen peptides as nutritional supplements	R.S.Singhal

B. TECH. (FOOD ENGINEERING & TECHNOLOGY) PROJECT			
1.	Ashishkumar Darji	Ready to Cook “High Protein Diet” Meat	S. Chakraborty
2.	Chinmay Kinage	In vitro inhibition of Advanced glycation end product (AGE) formation by phytoconstituents	Dr. Sadhana Sathaye
3.	Ruchir Agrawal	Flavoured sugar cubes	R.S. Singhal
4.	Noopur Mehta	Beverages of fruits and vegetables combination using fresh produce in Konkan region	S.S. Lele
5.	Meenakshi Gupta	Extraction and purification of EPA/DHA from fish oil.	Dr. Jyotsna Waghmare
6.	Manish Chauhan	Chemical Modification of Natural Colourants	Prof G. S. Shankarling
7.	Shubham Sawardekar	LDPE/Silver Nanoparticles Packaging Film	Dr. Adarsh Rao
8.	Vaishnavi Patki	Tea extraction using Ultrasound Technology	U.S. Annapure
9.	Vaidehi Narkar	Flavoured sugar cubes	R.S. Singhal
10.	Shubham Purandare	Beverages of fruits and vegetables combination using fresh produce in Konkan region	S.S. Lele
11.	Gautamraj Dadlani	Ready to Cook “High Protein Diet” Meat	S. Chakraborty
12.	Rohit Jorigal	Extraction and purification of EPA/DHA from fish oil.	Dr. Jyotsna Waghmare
13.	Pranav Raval	Tea extraction using Ultrasound Technology	U.S. Annapure
14.	Yash Kakani	In vitro inhibition of Advanced glycation end product (AGE) formation by phytoconstituents	Dr. Sadhana Sathaye
M. TECH. (FOOD ENGINEERING & TECHNOLOGY) SEMINARS			
1.	Aditi Runga	DNA barcoding for authentication of food commodities	R.S. Singhal
2.	Admajith Kaimal	Green extraction of food bioactive using cloud point technique	S.S. Arya
3.	Madan Dhulgande	Extraction of bioactive compounds by using subcritical water	S. Chakraborty
4.	Megha Dhingra	Effect of cold plasma on proteins in food systems	U.S. Annapure
5.	Naveen Kumar Shakya	Molecular distillation as separation technique from food commodities	R.S. Singhal
6.	Oilrila Ghosh	Use of membrane process for separation in food processing and for recovery of valueable components	L. Ananthnarayan
7.	Prateek Katariya	Electrohydrodynamic drying of fruit and vegetable quality energy aspects	S. Chakraborty
8.	Sagar Mahale	Waste management for mango processing industry	U.S. Annapure
9.	Sujay Ayachit	Recent development in browning and its inhibition	L. Ananthnarayan

10.	Omkar Sawant	Use of hydrodynamic cavitation in food processing	U.S. Annapure
11.	Dipak Gujar	Mead science and technology	S.S. Lele
M.TECH. (FOOD BIOTECHNOLOGY) SEMINARS			
1.	Abdur Rehman Moh. Kalim Khan	food derived bioactive peptides:opportunities and challenges	J.S.Gokhale
2.	Bisal prasher	Effect of cold plasma treatment on Enzymes	U.S. Annapure
3.	Deep kamal Dave	Fermentative Production of Phytoconstituents with Nutraceutical Value	L. Ananthnarayan
4.	G V Lathika	Microalgae as human food	S. Chakraborty
5.	Shreyasi phatak	Fermented Carbohydrates:chemistry,technology,healthy benefits and food applications.	S.S.Arya
6.	Shriya Das	Fortification of herbal extracts into beverage	S.S. Lele
7.	Sneha Kamble	Recent development in wines & beers: Science & Technology	S.S. Lele
8.	Stuti Agarwal	Paraprobiotics for development of functional foods-mechanism of action and negativity	R.S.Singhal
9.	Sudharshini B	Whole -cell catalysis for the production of chemicals	G.D.Yadav
M. TECH. (BIOPROCESS TECHNOLOGY)			
1.	Nitesh Punde	Production and extraction of cellulose by using sacchromyces boulardii through submerged fermentation	U.S. Annapure
2.	Pooja Motikar	Characterisation of mAb by light scattering techniques	R.D.Jain
3.	Priyanka Nakka	Downstream processing of valuable ingredients using waste from food industry	U.S. Annapure
4.	Ratnamala Marathe	Purification of glycerol and its conversion into value added products	S.B.Kale

RESEARCH TOPICS (THESIS WORK)

PH.D. (TECH.) [FOOD ENGINEERING AND TECHNOLOGY (FET)/ FOOD BIOTECHNOLOGY (FBT) / BIOPROCESS TECHNOLOGY (BPT)]

Sr. No.	Research Scholar & Sponsors	Previous Institute	Project Title	Date of Registration	Guide
1.	Jadhav Manisha*(UGC SAP)	SLIET, Punjab	Development of extruded food products based on sorghum (FET)	Sept 2010	U. S. Annapure
2.	Bawane Amruta*(UGC SAP)	SLIET, Punjab	Studies on stability of added constituents during extrusion (FET)	April 2014	R. S. Singhal

3.	Giri Shital*(UGC SAP)	LIT, Nagpur	Studies in development of low glycemic index foods (FET)	June 2011	L. Ananthanarayan
4.	Joshi Chetan (UGC SAP)	ICT, Mumbai	Fermentative production and downstream processing of zeaxanthin (BPT)	July 2011	R. S. Singhal
5.	Waghmare Aashish (UGC SAP)	ICT, Mumbai	Extraction of bio-oil and valuable products from microalgae (BPT)	July 2013	S. S. Arya
6.	Bhaskar Bincy* (DBT)	D.Y.Patil, Navi Mumbai	Studies on bioactive peptides from selected legumes commonly consumed in India (FBT)	July 2012	L. Ananthanarayan
7.	Gaikwad Sonali* (UGC-SAP)	MAU, Parbhani	Chemistry and technology of cereal-legume based Indian traditional food (FET)	July 2013	S. S. Arya
8.	Tupe Rupesh (UGC SAP)	ICT, Mumbai	Studies on functional foods (FET)	October 2012	L. Ananthanarayan
9.	Patil Sonal* (UGC SAP)	ICT, Mumbai	Studies on production and characterization of gluten-free flat bread (FET)	July 2013	S. S. Arya
10.	Sweta Deshaware *(DBT)	Amity University, Delhi	Study on genetic polymorphism of TAS2R38 bitter taste receptor gene in an Indian population and approaches for debittering of glycosides (FBT)	July 2012	R. S. Singhal
11.	K. V. Umesh (UGC SAP)	ICT, Mumbai	Enhancing bioavailability of nutraceuticals (FBT)	December 2012	R. S. Singhal
12.	Regubalan Baburaj	Anna University, AICT Campus, Chennai	Studies in microbial characterization, nutritional improvement and preservation of idli batter (FET)	September 2013	L. Ananthanarayan
13.	Shah Nirali Nitin*	ICT, Mumbai	Hydrophobic modification of biopolymers (FET)	May 2014	R. S. Singhal

14.	Desai Mihir Mukund	UICT, NMU, Jalgaon	Studies on indigenous oils and deoiled meals (FET)	September 2013	S. S. Lele
15.	Bhushette Pravin Rajkumar	UICT, NMU, Jalgaon	Study on new exudate gums (FET)	October 2013	U. S. Annapure
16.	Nagavekar Nupur Shantaram*	ICT, Mumbai	Extraction technologies for novel food ingredients (FBT)	May 2014	R. S. Singhal
17.	Sorde Karuna Liladas*	UICT, NMU, Jalgaon	Studies in fermentative production of microbial Transglutaminase (FBT)	October 2013	L. Ananthanarayan
18.	Kadam Deepak Sunil	ICT, Mumbai	Studies on utilization of Nigella sativum and Lepidiumsativum seed cake (FBT)	May 2014	S. S. Lele
19.	Singhu Bhupender	Shri Ramaswami Memorial University, Chennai	Enhanced production of glutathione (FBT)	October 2013	U. S. Annapure
20.	Bedade Dattatray Kashinath	ICT, Mumbai	Fermentative production, downstream processing and applications of acrylamidase (BPT)	May 2014	R. S. Singhal
21.	Tulamandi Sreedath	TNAU/Cornell University joint degree	Development of biopolymer films using agricultural biomass	January 2014	R. S. Singhal
22.	Chaudhari Bhushan	North Maharashtra University, Jalgaon	Study on new seed gums(FET)	April 2015	U. S. Annapure
23.	Ketan Mulchandani	ICT, Matunga	Studies on production and downstream processing of Deoxynojirimycin(BPT)	March 2017	R. S. Singhal
24.	Abhijit Muley	North Maharashtra University, Jalgaon	Modification of proteins for enhanced functionality(FBT)	September 2015	R. S. Singhal
25.	Seema Bajaj*	ICT, Matunga	Processing and storage stability of added vitamins in food(FET)	September 2015	R. S. Singhal

26.	Sachin Adsare	North Maharashtra University, Jalgaon	Studies in coconut processing (FBT)	April 2015	U. S. Annapure
27.	Anu Ahlawat*	GGs Indraprasth University	In process(FBT)	In process	L. Ananthanarayan
28.	Sowmya R. S.*	Karunya university, coimbatore	Studies on extractions and characterization of phytonutrients from hydroponically grown plants and their application in health food(FET)	In process	U. S. Annapure
29.	Aratrika Ray*	Sam Higginbottom university of Agriculture, Technology & Science, Allahabad,	In Process(FET)	In Process	R.S. Singhal
30.	Prasanna Bhalerao	UICT, NMU, Jalgaon	Non thermal processing of fruit beverages(FET)	In Process	S. Chakraborty
Ph.D. SCIENCE [BIOTECHNOLOGY (BT)/ BIOCHEMISTRY (BC)/ FOOD SCIENCE (FS)]					
1.	Subramaniam Jayshree*(UGC SAP)	Ruia College, Mumbai	Fermentative production and downstream processing of fucoxanthin (BT)	Aug 2010	R. S. Singhal
2.	Bagul Vaishali *(UGC SAP)	KTHM College, Nashik	Studies in fermentative production and downstream processing of docosahexanoic acid (BT)	August 2013	U. S. Annapure
3.	Insulkar Prajakta* (UGC SAP)	Birla College, Kalyan	Study of production of exopolysaccharide from halotolerant organisms and their biotechnological application (BT)	April 2015	S. S. Lele
4.	Rahman Momin Bilal M. (UGC SAP)	Institute of Science, Mumbai	Fermentative production and downstream processing of arginase (BT)	July 2013	U. S. Annapure
5.	Vaidya Aniruddha (UGC SAP)	Dept. of Microbiology, University of Pune	Development of phage-based biosensor (BT)	December 2012	U. S. Annapure

6.	Ghanate Aarti * (UGC SAP)	Shivaji University, Kolhapur	Studies in traditional foods: process and technology development (BT)	December 2012	U. S. Annapure
7.	Bhagwat Ashlesha * (UGC SAP)	K.J. Somaiya College, Mumbai	Studies in probiotics (BT)	December 2012	U. S. Annapure
8.	Jamakhani Majeed (UGC SAP)	SASTRA University, Tamilnadu	Study on isolation and characterization of tomato allergens (BT)	July 2013	S. S. Lele
9.	Amane Dhanashree * (UGC SAP)	K.J. Somaiya College, Mumbai	Development of biochemical methods for detection of adulteration in legume-based traditional food products (BC)	December 2012	L. Ananthanarayan
10.	Deorukhkar Anuradha *(UGC SAP)	SIES College,Sion	Biochemical studies and characterization of isoflavones occurring in commonly consumed Indian legumes (BC)	December 2012	L. Ananthanarayan
11.	Bannerji Anamika Amit *	SNDT University, Mumbai	Indian flat breads: physicochemical and nutrituional aspects (FS)	September 2013	S. S. Lele
12.	Janve Madhura Pramod *	University of Mumbai	Chelates of iron with amino acids and sugars for improved bioavailability and stability (FS)	September 2013	R. S. Singhal
13.	Bakshi Gayatri Girish *	University of Mumbai	Studies in pectinase enzymes and associated inhibitors in selected fruits (FS)	September 2013	L. Ananthanarayan
14.	Salve Akshata Raosaheb *	University of Mumbai	Development of peanut based functional foods (FS)	September 2013	S. S. Arya
15.	Dash Pratipanna *	University of Mumbai	Studies on enzymatic protein hydrolysis and characterization of protein hydrolysates (BC)	October 2013	L. Ananthanarayan
16.	Pathan Fayaz Latif	MPKV, Rahuri	Studies on effect of plasma processing on physicochemical properties of legumes (FS)	May 2014	U. S. Annapure

17.	Vernekar Manvi Jayant *	Ruia College Mumbai	Elucidating the gene-diet-disease interaction of polyunsaturated fatty acid metabolism (BT)	December 2012	R. S. Singhal
18.	Sandesh Marathe	Fergusson College, Pune	Enzymatic biotransformation of sugars and polyphenols for enhanced functionality(BT)	November 2017	R. S. Singhal
19.	Amruta Karangutkar*	Khalsa College, Matunga	Studies on extraction , purification, characterization & stabilization of natural pigments(FS)	September 2015	L. Ananthanarayan
20.	Riddhi Sota*	LTMM College, Sion	In Process(BC)	In Process	L. Ananthanarayan
21.	Santosh Pradhan	Mumbai University, Kalina	Detection and degradation of AFB, in food commodities and products(BC)	April 2017	L. Ananthanarayan
22.	Mohmad Sajeed Bhat	SLIET, Punjab	In Process(FS)	In Process	S. S. Arya
23.	Nitisha Naik*	Ruia College, Matunga	In Process(FS)	In Process	R. S. Singhal
24.	Sumankumari Maurya*	Delhi University	In process(FS)	In process	U. S. Annapure
25.	Anusha Mishra*	Punjab Agricultural University, Ludhiana	In Process(FS)	In Process	U. S. Annapure

M.TECH. (FOOD ENGINEERING & TECHNOLOGY)

1.	Abisheka Pandian T.	IIFPT, Thanjavur, Tamilnadu	Quality monitoring of paneer using TTI during cold storage	April 2018	S.Chakraborty
2.	Harshal*	Punjab agricultural university, Ludhiana, Punjab	Novel products from fruit seeds	April 2018	S.S.Lele
3.	Kakoli Pegu*	Central institute of technology, Kokrajhar, Assam	Effect of processing on bioactive compounds of fruit & vegetable	April 2018	S.S.Arya
4.	Kapil Rai	ANGRAU, Hyderabad	Flavoured sugar cubes with ginger	April 2018	R.S.Singhal

5.	Kishori Balu Panmand*	Dept. of technology, Shivaji university, kolhapur	Development & preservation of sugar free confectionary	April 2018	L. Ananthnarayan
6.	Krutika Anil Bhangale*	Laxminarayan institute of technology, Nagpur	Modification of non-commercial gums using cold plasma treatment	April 2018	U. S. Annapure
7.	Nivedita N.V.*	Anna university, Chennai	Effect of cold plasma on oil	April 2018	U. S. Annapure
8.	Rishab Dhar	Tezpur University, Assam	Beverage from underutilized tropical fruits: value addition, process optimization and shelf life extension	April 2018	S.Chakraborty
9.	Shubham Goyal	NIFTEM, Kundli, Haryana	Bitterness mashing of momordica chavantia linn(bitterguard) by microencapsulation of bitterguard juice using spray drying method	April 2018	S.S.Arya
10.	Sneha Awasthi*	UAS bangluru, karnataka	Osmotically dehydrated ginger candy	April 2018	R.S.Singhal
11.	Saeed Nikam*	S.P. college of food technology, Dahivali	Raw and ripe jackfruit utilisation	April 2018	S.S.Lele
M. TECH. (FOOD BIOTECHNOLOGY)					
1.	Alisha Sukhija*	VIT, Vellore	Mead production from honey fermentation	April 2018	U. S. Annapure
2.	Harsha Jagdish Bharwani*	Thadomal shahani engg. College, Mumbai	Effect of processing on allergens of whitepeas and their analysis	April 2018	S.S.Arya
3.	Mukesh Kumar Patel	G.B. Pant university of Agri. & Tech. Pantnagar	Production & characterization of dextran by L.mesentericoles using tomato juice with sucrose	April 2018	S.Chakraborty
4.	Nitin Sukhdev Sangle	M.G.M. college of Engg. & Technology	Development of functional food product using fermented fungri seed flour	April 2018	J.S.Gokhale

5.	Prabhat Chauhan	UIET, MDU, Rohtak, Haryana	Medicinal important metabolites from <i>S. bouldardii</i>	April 2018	U. S. Annapure
6.	Sana Jameel Shaikh*	KSK college of food technology, Beed	Development of dry naturally leavened Idli premixes with accelerated fermentation	April 2018	L. Ananthnarayan
7.	Shaikh Lubna Bagum*	MGM college of food technology, Aurangabad	Studies on fruit wines from plant material	April 2018	S. S. Lele
8.	Shraddha Srinivasan*	SASTRA University, Chennai	Screening and evaluation of food commodities for their anti hangover effect	April 2018	R.S.Singhal
9.	Shubham Bharat Gaikwad	MGM Jawaharalal Nehru Engg. College, Aurangabad	Bioactives from fish waste	April 2018	S.S.Arya
10.	Sumita Kumari*	VIT University, Vellore	Study of cajanus cajan and lathyrus satires using molecular biology techniques	April 2018	L. Ananthnarayan
M.TECH (BIOPROCESS TECHNOLOGY)					
1.	Vaibhav Kalokhe	AISSMS College of pharmacy, Pune	Fermentative production of inulinase from <i>saccharomyces bouldardii</i>	April 2018	U. S. Annapure
2.	Niddhi Kulkarni*	BVBCET, Hubli, Karnataka	Immobilization & acrylamidase enzyme using crosslinkers	April 2018	R.S.Singhal
3.	Vasudha Borkar*	Sharad Pawar College of Pharmacy, Nagpur	Production, purification and characterization of naringinase from <i>aspergillus niger</i> van tieghem using citrus solid waste	April 2018	J.S.Gokhale
4.	Shyam Mewada	VNS institute of Pharmacy, Bhopal	Development of functional probiotic beverage from Beet-root and tomato	April 2018	S.S.Arya
M.TECH (GREEN TECHNOLOGY)					
1.	Ankita Gawas*	SIES, GST, Nerul	Biosorption of heavy metals using dried coconut leaves	April 2018	J.S.Gokhale

POST-DOCTORAL FELLOWS RESEARCH PROJECTS

Sr. No.	Post-Doctoral Fellow	Previous Institute	Project Title	Guide
1.	Kriti Kumari Dubey*	University of Mumbai	Microbial fermentation of Tea	R. S. Singhal
2.	Hemant P. Borse	North Maharashtra university, Jalgaon	Toxicological evaluation of chemically & biologically synthesized nanoparticles	R. S. Singhal
3.	Chhanwal Narayasing	CFTRI, Mysore	In Process	R. S. Singhal

DEGREES AWARDED

Sr. No.	Name of the Student	Title	Guide
M. TECH. (FOOD ENGINEERING & TECHNOLOGY)			
1.	Cheryl Fernanded*	Development of Multi-Grain functional beverage	S.S.Arya
2.	Vrushti Shah*	To study the effect of cereal flour ingredients on rheological & tectural	L. Ananthanarayan
3.	Bulbul Vij*	Studies on effect of cold plasma treatment on commercial gums	U. S. Annapure
4.	Aroshi Sharma*	Studies on isolation and physiochemical characterization of plant gum exadates	U. S. Annapure
5.	Vardan Singh	Studies on Rosella and its food applications	S. S. Lele
6.	Swarnali Das*	Studies in the development of healthfull fruit beverages	L. Ananthanarayan
7.	Divya M.*	Studies on development of functional flat bread incorporated with flaxseed	S. S. Lele
8.	Niharika Soni*	Modification of guar gum using clodecerul succinic anhydride	R. S. Singhal
9.	Ashwini Kumar	Studies on oleogels: formulation functionality & its application	R. S. Singhal
M. TECH. (FOOD BIOTECHNOLOGY)			
1.	Shraddha Sontakke*	Non-conventional plant growth regulators	R. S. Singhal
2.	Sanjogita Gosavi*	Studies on fermented functional novel flat bread	S.S. Arya
3.	Vaishali Mishra*	Studies on beer processing	U. S. Annapure
4.	Deepanshu Garg	Development of a functional food product using prosopioneraria	J.S. Gokhale
5.	Manjusha Joardar*	Integration of biotechnology in food products	S. S. Lele
6.	Saaylee Danait*	Studies on novel, functional, probiotic yoghurt from peanut milk	S.S. Arya
7.	Pratiksha Avhad*	Isolation and production of melatonin from saccharomyces boulardii	U. S. Annapure

8.	Rutumbara Haripurkar*	Extraction of carotenoids from plant sources and its applications	L. Ananthanarayan
9.	Priyanka Sawant*	Enzyme assisted aqueous extraction of flaxseed oil	R. S. Singhal
10.	Sruthy Thanakudan*	Studies in the development of sourdough breads	L. Ananthanarayan
M.TECH. (BIOPROCESS TECHNOLOGY)			
1.	Bhupendra Thakre	Production of cellulose from saccharomyces boulardii using food industrial waste	U. S. Annapure
2.	Gyanendrakumar Gautam	Extraction of carotenoids from micro algae with the help of cloud point extraction method.	S.S.Arya
3.	Rathi Sushilshrinivas	Computational studies of anaerobic digester and process optimization	J.S. Gokhale
Ph.D. (TECH) [FOOD ENGINEERING AND TECHNOLOGY (FET)/ FOOD BIOTECHNOLOGY (FBT)/ BIOPROCESS TECHNOLOGY (BPT)]			
1.	Datta Suprama*	Characterization and profiling of Saccharomyces boulardii (BT)	U. S. Annapure
2.	Anuja Kulkarni*	Studies in biotechnological aspects of food allergens (FBT)	L. Ananthanarayan
3.	Sandeep Chaudhari	Fermentative production, downstream processing and applications of microbial cutinase (BPT)	R. S. Singhal
4.	Rahul Rathod	Development of extruded food product (FET)	U. S. Annapure
5.	Sachin Sonawane	Studied on fruit seed peptides and its application in food preservation (FET)	S. S. Arya
6.	Chetan Arekar	Studies in tropical fruit wines (FBT)	S. S. Lele
Ph.D. SCIENCE (BIOTECHNOLOGY)			
1.	Manvi Vernekar*	Elucidating the gene-diet-disease interaction of polyunsaturated fatty acid metabolism	R. S. Singhal
Ph.D. SCIENCE (BIOCHEMISTRY)			
1.	Chandras Visavasrao	Biochemical characterization of selected indigenous fruit varieties during ripening and extended shelf life (BC)	L. Ananthanarayan
2.	Mugdha Dabir*	Studies in characterization and deactivation of fruit based enzymes (BC)	L. Ananthanarayan

SPONSORED PROJECTS

GOVERNMENT AGENCIES

Sponsor	Title	Duration	Amount	Principal Investigator	Co-investigator
RGSTC, Govt. of India	Techno-commercial Viability Studies for Small Scale Fruit Winery	2018-2020	31.76 lakhs	Prof.S.S.Lele	--
DBT	Developing of mushroom germplasma bank for western coast of India with special emphasis on Maharashtra and Goa to commercialize their nutraceutical and pharmaceutical potential	2015-2017	2.7 lakhs	Prof.S.S.Lele	--
RGSTC, Govt. of India	Exotic tropical fruit wines : microbrewery demo plant	2014-2017	67.27 lakhs	Prof.S.S.Lele	--
DST-SERB	Pulse light processing of beverage using under-utilized fruits: value addition, process optimization & shelf life extension	April 2017 – Mar 2020	48 Lakhs	Dr. Snehasis Chakraborty	--
DST-international bilateral co-op division, New Delhi (Indo srilankan joint project)	Studies in surface sterilization of spices using non thermal processing	November 2017- November 2019	26,48,000/-	Prof. U. S. Annapure (India)	Dr.P.N.R.J Amunogoda (Srilanka)
DST-SERB	Novel, non-thermal, energy efficient, industrially scalable hydrodynamic cavitation (HC) processing of milk for enhanced nutrients and shelf life extension	2018-2021	43,06,000/-	Dr.S.S.Arya	--
MOFPI	Novel, non-thermal, energy efficient, industrially scalable hydrodynamic cavitation processing of indigenous fruit juices for enhanced nutritional bioactives and shelf life extension	2018-2020	49,30,560/-	Dr.S.S.Arya	--

PRIVATE AGENCIES

Sponsor	Title	Duration	Amount	Principal Investigator
Bühler India Pvt Ltd, Bangalore	Assessment of tur dal quality	2018-19	2,50,750/-	Dr. Shalini S. Arya
Zen Tiger Kombucha, Mumbai	Shelf life and quality study of Kombucha	2018	1,75,000/-	Dr. Shalini S. Arya
Faraway Foods, Mumbai	Development of fruit leathers	2017	2,30,000/-	Dr. Shalini S. Arya
Tata Trust and Government of Maharashtra, Mumbai, India	Usage study of Fortified Wheat and Monitoring	2016-17	3,00,000/-	Dr. Shalini S. Arya
Bühler India Pvt Ltd., Bangalore, India	Physical, chemical, nutritional characterization and product development of besan	2016-17	4,33,125/-	Dr. Shalini S. Arya
Godrej & Boyce Mfg Co Ltd, India	Parametric study and data analysis in the process of developing cooking aids	April - September 2017	2 lakhs	Prof. Uday S. Annapure/Dr. S.Chakraborty
THINQ Pharma CRO. LTD	Anti-Hangover Formulation	17th June 2017- 17th December 2017	4.51 lakhs	Prof. R.S.Singhal

DETAILS OF NATIONAL AND INTERNATIONAL COLLABORATIONS

Collaborating University/ Institute	Topic of Investigation	Student
BARC, Mumbai	Studies on bioactive peptides from selected legumes commonly consumed in India	Bhaskar Bincy
BARC, Mumbai	Development of phage-based biosensor	Vaidya Aniruddha
BARC, Mumbai	Study on genetic polymorphism of TAS2R38 bitter taste receptor gene in an Indian population and approaches for debittering of glycosides	Sweta Deshaware
Bombay Hospital, Mumbai	Elucidating the gene-diet-disease interaction of polyunsaturated fatty acid	Vernekar Manvi

National Chemical Laboratory, Pune	Fermentative production, downstream processing and applications of microbial cutinase	Choudhari Sandeep
Queens University, Belfast, Ireland	Characterization and profiling of <i>Saccharomyces boulardii</i>	Datta Suprama
Paul Ehrlich Institute, Langden	Studies on legume allergens	Anuja Kulkarni
TERI, Mumbai	Mushroom	Dr. Anjali Parasnis
Himedia	Studies on extractions and characterization of phytonutrients from hydroponically grown plants and their application in health food	Sowmya R. S.
National Botanical Research Institute, Lucknow	Plant genomics lab	Anuradha Deorukhkar
Sahyadri educational society, Chiplun	Fruit wine research and training.	Sae Nikam, Deepak Gujar

RESEARCH PUBLICATIONS

PROFESSOR REKHA S. SINGHAL

Title	Author	Journal
Non-covalent conjugation of cutinase from <i>Fusarium</i> sp. ICT SAC1 with pectin for enhanced stability: Process minutiae, kinetics, thermodynamics and structural study	Muley, A.B., Chaudhari, S.A., Singhal, R.S.	International Journal of Biological Macromolecules 102, pp. 729-740(2017)
Genetic variation in bitter taste receptor gene TAS2R38, PROP taster status and their association with body mass index and food preferences in Indian population	Deshaware, S., Singhal, R.	Gene, 627, pp. 363-368(2017)
Enhancing anti-diabetic potential of bitter gourd juice using pectinase: A response surface methodology approach	Deshaware, S., Gupta, S., Singhal, R.S., Variyar, P.S.	LWT - Food Science and Technology, 86, pp. 514-522(2017)
Evaluation of debittered and germinated fenugreek (<i>Trigonella foenum graecum</i> L.) seed flour on the chemical characteristics, biological activities, and sensory profile of fortified bread	Chaubey, P.S., Somani, G., Kanchan, D., (...), Varakumar, S., Singhal, R.S.	Journal of Food Processing and Preservation, 42(1), e13395(2018)
Zeaxanthin production by <i>Paracoccus zeaxanthinifaciens</i> ATCC 21588 in a lab-scale bubble column reactor: Artificial intelligence modelling for determination of optimal operational parameters and energy requirements	Joshi, C., Singhal, R.S.	Korean Journal of Chemical Engineering, 35(1), pp. 195-203(2018)

Enhanced extraction of oleoresin from <i>Piper nigrum</i> by supercritical carbon dioxide using ethanol as a co-solvent and its bioactivity profile	Nagavekar, N., Singhal, R.S.	Journal of Food Process Engineering, 41(1), e12670(2018)
Extraction and characterization of chitosan from prawn shell waste and its conjugation with cutinase for enhanced thermo-stability	Muley, A.B., Chaudhari, S.A., Mulchandani, K.H., Singhal, R.S.	international journal of biological macromolecules, 111, pp. 1047-1050(2018)
A two-tier modified starch-oxidation followed by n-octenyl succinylation as gum Arabic substitute: Process details and characterization	Shah, N.N., Singhal, R.S.	journal of food engineering, 226, pp. 96-104(2018)

BOOK CHAPTERS

Title	Authors	Reference
Microbial polyaminoacids: an overview for commercial attention	Sandip B. Bankar, Pranhita R. Nimbalkar, Prakash V. Chavan, Rekha S. Singhal	Role of Materials Science in Food Bioengineering, edited by Alexandru Mihai Grumezescu, Alina Maria Holban, Chapter 12, pp. 381-412, Academic Press, copyright © Elsevier Inc., March 2018, ISBN: 978-0-12-811448-3.

REVIEW PAPER

Title	Authors	Reference
Modification of proteins and polysaccharides using dodecyl succinic anhydride: Synthesis, properties and applications	Nirali N. Shah, Niharika Soni and Rekha S. Singhal	International Journal of Biological Macromolecules, 107: 2224-2233 (2018)

PROFESSOR S. S. LELE

Title	Author	Journal
Cross-linking effect of polyphenolic extracts of <i>Lepidium sativum</i> seedcake on physicochemical properties of chitosan films	Kadam, D., Lele, S.S.	International Journal of Biological Macromolecules 114, 1240-1247(2018)
An investigation on the effect of polyphenolic extracts of <i>Nigella sativa</i> seedcake on physicochemical properties of chitosan-based films	Kadam, D., Shah, Nirali., Palamthodi, S., Lele, S.S.	Carbohydrate Polymers. 192: 347-355 (2018)
LC-ESI-Q-TOF-MS/MS profiling and antioxidant activity of phenolics from <i>L. Sativum</i> seedcake.	Kadam, D., Palamthodi, S., Lele, S.S.	Journal of Food Science and Technology. 55(3): 1154-1163 (2018)

BOOK CHAPTERS

Title	Authors	Reference
Azo dye Discoloration by Fungi, In Fungal Bioremediation: Fundamentals and Applications	M.R. Vernekar., J.S. Gokhale and S. S. Lele.	CRC Press, Taylor & Francis (2018).

PROF. U. S. ANNAPURE

Title	Author	Journal
Development of cowpea-based (<i>Vigna unguiculata</i>) extruded snacks with improved in vitro protein digestibility	Jakkanwar, S.A., Rathod, R.P., Annapure, U.S.	International Food Research Journal, 25(2), pp. 804-813(2018)
Modification of starch using low pressure radio frequency air plasma	Banura, S., Thirumdas, R., Kaur, A., Deshmukh, R.R., Annapure, U.S.	LWT - Food Science and Technology, 89, pp. 719-724(2018)
Synthesis of metal free ultrathin graphitic carbon nitride sheet for photocatalytic dye degradation of Rhodamine B under visible light irradiation	Rahman, S., Momin, B., Higgins, M.W., Annapure, U.S., Jha, N.	AIP Conference Proceedings, 1942, 120017(2018)
Physicochemical, functional and rheological investigation of <i>Soymida febrifuga</i> exudate gum	Bhushette, P.R., Annapure, U.S.	International Journal of Biological Macromolecules, 111, pp. 1116-1123(2018)
Integrated effect of radiation processing and modified atmosphere packaging (MAP) on shelf life of fresh fig	Waghmare, R.B., Annapure, U.S.	Journal of food science and Technology, 55(6), pp. 1993-2002(2018)
Plasma activated water (PAW): Chemistry, physico-chemical properties, applications in food and agriculture	Thirumdas, R., Kothakota, A., Annapure, U., (...), Gatt, R., Valdramidis, V.P.	Trends in Food Science and Technology, 77, pp. 21-31(2018)
Bacteriophages for pre- and post-contamination biocontrol of artificial <i>Escherichia coli</i> contamination in carrots	Vaidya, A., Ravindranath, S., Annapure, U.S.	LWT, 97, pp. 193-197(2018)

DR. LAXMI ANANTHANARAYAN

Title	Author	Journal
Rheological and nutritional studies of amaranth enriched wheat chapatti (Indian flat bread)	Banerji, A., Ananthanarayan, L., Lele, S.	journal of food processing and preservation, 42(1), e13361(2018)
Extruded black gram flour: Partial substitute for improving quality characteristics of Indian traditional snack	Ananthanarayan, L., Gat, Y., Kumar, V., Panghal, A., Kaur, N.	journal of ethnic foods, 5(1), pp. 54-59(2018)

Partial purification and characterization of the quality deteriorating enzymes from Indian pink guava (<i>Psidium guajava</i> L.), var. Lalit	Vishwasrao, C., Ananthanarayan, L.	Journal of food science and technology, 55(8), pp. 3281-3291(2018)
Kinetics of inactivation of quality-deteriorating enzymes and degradation of selective phytoconstituents in pink guava pulp during thermal processing	Vishwasrao, C., Ananthanarayan, L.	Journal of Food Science and Technology, 55(8), pp. 3273-3280 (2018)

DR. S. S. ARYA

Title	Author	Journal
Bioactive L acidissima protein hydrolysates using Box- Behnken design	Sonawane, S.K., Arya, S.S.	3 Biotech, 7(3), 218(2017)
Nutritional evaluation of multigrain Khakra	Chauhan, S., Sonawane, S.K., Arya, S.S.	Food Bioscience, 19, pp. 80-84(2017)
Nutritional, functional, phytochemical and structural characterization of gluten-free flours	Patil, S.P., Arya, S.S.	Journal of Food Measurement and Characterization, 11(3), pp. 1284-1294(2017)
Citrullus lanatus protein hydrolysate optimization for antioxidant potential	Sonawane, S.K., Arya, S.S.	Journal of Food Measurement and Characterization, 11(4), pp. 1834-1843(2017)
Encapsulation characteristics of protein hydrolysate extracted from <i>Ziziphus jujube</i> seed	Kanbargi, K.D., Sonawane, S.K., Arya, S.S.	International Journal of Food Properties, 20(12), pp. 3215-3224(2017)
Comparative assessment of algal oil with other vegetable oils for deep frying	Waghmare, A., Patil, S., LeBlanc, J.G., Sonawane, S., Arya, S.S.	Algal Research, 31, pp. 99-106(2018)
Bioactive characteristics and optimization of tamarind seed protein hydrolysate for antioxidant-rich food formulations	Bagul, M.B., Sonawane, S.K., Arya, S.S.	3 Biotech, 8(4), 218(2018)
Food waste compost as an organic nutrient source for the cultivation of <i>Chlorella vulgaris</i>	Chew, K.W., Chia, S.R., Show, P.L., (...), Arya, S.S., Chang, J.-S.	Bioresource Technology, 267, pp. 356-362(2018)

BOOK CHAPTERS

Title	Authors	Reference
Bioactive Compounds and Health Benefits of Jamun (<i>Syzygiumcumini</i>)	Arya S.S., Pegu K., Sadawarte P.D.	Mérillon JM., Ramawat K. (eds), Bioactive Molecules in Food. Reference Series in Phytochemistry, Springer, Cham, 2018

DR. JYOTI S. GOKHALE

BOOK CHAPTERS

Title	Authors	Reference
Azo dye Discoloration by Fungi, In Fungal Bioremediation: Fundamentals and Applications	M.R. Vernekar., J.S. Gokhale and S. S. Lele.	CRC Press, Taylor & Francis (2018).

DR. SNEHASIS CHAKRABORTY

Title	Author	Journal
Effect of high pressure thermal processing on the quality attributes of Aloe vera-litchi mixed beverage	Swami Hulle, N.R.,Chakraborty, S., Rao, P.S.	Innovative food science and Emerging Technologies, 40, pp. 68-77(2017)
Partial purification, characterisation and thermal inactivation kinetics of peroxidase and polyphenol oxidase isolated from Kalipatti sapota (Manilkara zapota)	Vishwasrao, C., Chakraborty, S.,Ananthanarayan, L.	Journal of the Science of Food and Agriculture, 97(11), pp. 3568-3575(2017)
Bread from wheat flour partially replaced by fermented chickpea flour: Optimizing the formulation and fuzzy analysis of sensory data	Shrivastava, C., Chakraborty, S.	LWT - Food Science and Technology, 90, pp. 215-223(2018)

IN-HOUSE COMMITTEES & RESPONSIBILITIES

FACULTY

Sr. No.	Faculty Name	Department Level Responsibility	Institute Level Responsibility
1.	Professor Smita S. Lele	Summer Training and Campus (IPT and Placement cell)	Registrar Member, Legal Cell, Appellate Comitee and other Exam related Committees and several others as Registrar.
2.	Professor Rekha S. Singhal	Departmental TEQIP coordinator	Member, Students' Welfare TEQIP coordinator, Faculty Activities
3.	Dr .Uday S. Annapure	Head, FETD	Co-Chair, UG Admission Committee Chair, Warden Committee Member, Anti-Ragging Committee Member, AICTE Accreditation Committee Member, Standing Committee for SC/ST Member, Institute Review Committee (DTE) Member, ICT Handbook Committee Academic Nodal Officer – TEQIP
4.	Dr. Laxmi Ananthanarayan	Co-ordinator, Food Biotechnology course	-

5.	Dr Shalini S. Arya	Co-ordinator : Departmental Activities	Nodal Officer, District Social Welfare Office Member, Equal Opportunity Cell (EOC) Member, Unfair Means in Examinations and Vigilance squad committee Member, Member, Cultural Activity Committee, Member, Hostel committee Member, Anti-Ragging Committee
6.	Dr.Jyoty S. Gokhale	-	Warden Hostel No. 3 Member, Timetable Committee
7.	Dr. Snehasis Chakraborty	-	Canteen & catering

SEMINARS/LECTURES/CONFERENCES/WORKSHOP/SUMMER OR WINTER TRAINING SCHOOLS ATTENDED/ORAL OR POSTER PRESENTATIONS

SEMINARS/ CONFERENCES ATTENDED

PROFESSOR S. S. LELE

- **Sawarde Valley Food Foundation** (SVFF) in collaboration with Institute of Chemical Technology organized two successive one week “**Mango, Jamun & Other Fruit Wine Making**” **Workshops** in June, 2018 with support from TEQIP III. This workshop, held at Sawarda, Chiplun, was specially designed for training students, beginners, amateur wine makers and budding entrepreneurs in basic principles and skills involved in wine making. The workshop included modules on fruit selection and characterization, fruit processing, upstream and downstream processing of wine, routine wine analysis, sensory evaluation techniques, and finance and market opportunities. The sessions comprised of lectures, demonstrations and

hands on training. Lectures was conducted by my M Tech students, Miss. Sae Nikam, Miss.Lubna Shaik, and Mr. Dipak Gujar.

- **Unnat Bharat Abhiyan** - ICT took a part into this programme.
- Under this programme, 5 villages were selected from Chiplun taluka.
- Main objective of this programme was to collect details of schools and analyze the passing percentage of each school.
- ICT arranged a visit to Aamdass High School, Chiplun on 6th August 2018.
- Programme taken into two sessions
 - **Session 1** - Prof. S. S. Lele, coordinator, UBA, Registrar, ICT, delivered a speech on “Appropriate Career selection and planning”. The speech included how to develop positive thinking, personality building and how to choose

appropriate career to suit your strengths, mindset and capabilities as well as passion. If passion is profession, you are very successful and happy too.

- **Session 1** - Parallely, 16 ICT students interacted and mingled with 60 9th standard students to motivate them and share exam tricks and how to score well and how to prepare for the board exams.
- Attended Management training Programme on “Advanced Pedagogy and Management Capacity Building” Training for Engineering Faculty and Senior Administrators “conducted from 21-25 June 2018 at Gaangtok (Sikkim) by Institute of Engineers, FDP cell.
- Attended, Ideas, Innovation & Industry enabling smart food factories organized by NAFARI on March3, 2018, Pune.

DR. UDAY S. ANNAPURE

- "Cold Plasma Processing for Food and Agriculture" an invited talk at National Conference on "Food and Agriculture Biotechnology" organised by Department of Biotechnology at Sinhgad College of Engineering, Vadgaon, Pune during 14th and 15th September, 2017.
- "Innovative practices in food technology" an invited talk at Kohinoor Art, Commerce and Science College, Khultabad, Aurangabad on 23 Dec 2017.
- "Entrepreneurship Development in Soy Food Processing" an invited talk at the hotel "The Peninsula Grand" in Mumbai on the June 29th, 2018.
- "Digitalisation in food technology" an invited talk at AICTE-ISTE Approved Short Term Training Program St. Francis Institute of Technology, Mumbai 400103. On 3 June 2018
- Food regulation overview organised by agile technologies at hotel majestic court New Mumbai on 11 Jan 2018

DR. SNEHASIS CHAKRABORTY

- Attended a international conference on Technologies for value addition in food products , " Non-thermal Processes: Advanced Technologies for Food Processing and Preservation" at Chandigarh, India on 20 Jul, 2017.

SPECIAL LECTURES /**VISITS****PROFESSOR REKHA S. SINGHAL**

1. Health and Wellness through Affordable Food Technology, Seminar on 'Prosperity through Science & Technology, organized by Marathi Vidnyan Parishad, Nehru Science Centre, February 16, 2018.
2. A lecture delivered at a workshop on Food Preservation Techniques "Supercritical fluid extraction of biomolecules", organized by BIRAC, New Delhi at ICT, Mumbai on February 15-17, 2018.
3. Food as a complex matrix of chemicals and materials: some innovations, plenary lectured at National Conference ICLS-2018 on "Innovations in Chemistry - Laboratory to Society (ICLS-2018)", North Maharashtra University, Jalgaon, March 5-6, 2018.
4. The following lectures were delivered at Dept of Studies in Food science & Nutrition, University of Mysore, Mysore 570006, March 23, 2018:

- a) Microencapsulation of sensitive food constituents
- b) Nutraceuticals for joint health

PROFESSOR S. S. LELE

1. Talk on " How to stay fit, happy and be efficient at work", during capacity building program for support staff, organized by

the Institute of Engineers, at Gangtok, talk on 24th June, 2018

2. Delivered a talk on "Fruit processing ", in the Devgad Cluster of 100 entrepreneurs, on 7th Jan 2018.
3. Resource person at the UGC faculty development program for biotechnology, at Vaze College, delivered a talk on Bioprocessing of fruit vegetable waste, 15th Oct 2017.

DR. UDAY S. ANNAPURE

1. Invited to talk on DBT sponsored National Conference on Recent Trends in Food & Agri Biotech Organised by Dept. Of Biotechnology at Sinhgad College of Engineering , Pune on 14-15 September 2017.
2. Invited Guest of Honour at Nutrition week 2017 organised by ICT, Mumbai in Association with AFST Mumbai at ICT on 7th September 2017

DR. S.S ARYA

1. Attended a training on Science Leadership Workshop for New Global Young Academy Members at 8th International Conference of Young Scientists & Annual General Meeting of the Global Young Academy, at Pattaya, Thailand on 7-11 May, 2018.
2. Attended a training on Level 2 workshop on Research Based Pedagogical Tools National Science Academy (INSA), New Delhi, India and Centre of Excellence in

Science and Mathematics Education (CoESME), Indian Institute of Science Education and Research (IISER), Pune and Sheffield Hallam University, UK on

6-8, December, 2017.

3. Attended a training on Level 1 Teacher Training Workshop on Research Based Pedagogical Tools, Pt. Ravishankar Shukla

University, Raipur, Chhattisgarh and Sheffield Hallam University, UK on 6-9, October, 2017.

ORAL/POSTER PRESENTATIONS

PROFESSOR REKHA S. SINGHAL

1. Poster presented at 10th World Congress on Chemical Engineering (Applied Biotechnology) on Isolation of acrylamidase from *Arthrobacter* sp. DBV1 and its ability to biodegrade acrylamide, Dattatray K. Bedade and Rekha S. Singhal at Barcelona, Spain on October 1-5, 2017.
2. Oral Presentation presented on Immobilization of acrylamidase from novel isolate, *Cupriavidus oxalaticus* ICTDB921 for mitigation of acrylamide from roasted coffee, a Novel competition for 3 minute presentation on Ph.D. topic organized by UDCT alumni association on the occasion of foundation day on may 11, 2018 at ICT, Mumbai. (Won the first prize (10,000 rupees) for this competition).

DR. UDAY S. ANNAPURE

- **Following posters were presented at 26th Indian Convention of Food Scientists and Technologists (ICFoST) 2017 on Food and Nutrition Challenges: Role of Food Science and Technology organised by AFST(I)-HQ in association with Hyderabad Chapter during December 7-9, 2017, CSIR-IICT, Hyderabad.**

- 1) Effect of various processing method on antinutritional factors and protein and starch digestibility of varieties of pigeon pea dhal (*Cajanus cajan*), Aarti Ghanate and U.S. Annapure.
- 2) Soy mid a f e b r i f u g a exudates gum an encapsulating agent, Bhushette P.R. and U.S. Annapure.
- 3) Bioactive properties of oil extracted from Coconut

Testa, Sachin Adsare and U.S. Annapure

DR. LAXMI ANANTHANARAYAN

- **Following posters were presented at 5th Bioprocessing india conference organized by IIT Guwahati during 9-11 December, 2017.**

1. Effect of degree of hydrolysis on the functional properties, antioxidant and ace inhibitory activities of whole horse gram flour' by bincy bhaskar, laxmi ananthanarayan, (Best poster Award)
2. Effect of processing methods commonly used in indian households on isoflaone content in indian legumes' by anuradha deorukhkar, laxmi ananthanarayan

SEMINARS / WORKSHOPS ORGANIZED

- **Food engineering and technology department, ICT and BIRACA organised workshop on Food Preservation Techniques on 26-28 Feb, 2018 at ICT, Matunga, Mumbai.**

- **Two workshops were organized with hands on training on non-grape fruit wine making in collaboration with Sahyadri Education Society at Chiplun during May 4- 8,**

2018 and during June 14- 21, 2018. Over 20 persons from nearby area participated. The workshops were sponsored by TEQIP III.

ENDOWMENT AND OTHER LECTURES ORGANIZED IN THE DEPARTMENT

Sr. No.	Date	Fellowship	Distinguished Speaker / Affiliation	Title of Lecture
1.	Friday, Dec 29, 2017	-	Dr. P. Neville R. J. Amunugoda, Industrial Technology Institute (ITI), Colombo, Sri Lanka	Initiatives of Non-thermal Food Processing in Sri Lanka: An overview
2.	Tuesday Dec 12, 2017	-	Professor Keshavan Niranjana Professor of Food Bioprocessing Editor, Journal of Food Engineering Department of Food and Nutritional Sciences University of Reading	New Product Development (NPD) in food business
3.	Friday, Jan 19, 2018	Guest Lecture	Dr. C. Anandharamkrishnan, Director, Indian Institute of Food Processing Technology, Thanjavur, India	Current and future prospects of nanotechnology in food processing
4.	Tuesday 28th November, 2017	Marico Industries Visiting Fellowship	Dr. Shyam S. Sablani, Associate Department Chair Department of Biological Systems Engineering, Washington State University	Polymer Packaging for Advanced Food Processing Technologies

INDUSTRIAL CONSULTANCY

Company	Area of Advice	Period
Godrej & Boyce Mfg Co Ltd, India	Parametric study and data analysis in the process of developing cooking aids	2017
Kargill India Pvt Ltd	Low GI wheat grits	June-July 2018
Sawardevalley food foundation Chiplun	Non-grape fruit wine and other fruit processing activities.	2017

DETAILS OF MASTERS/PH.D. STUDENTS SUPERVISED

PH.D. (TECH) (FOOD ENGINEERING AND TECHNOLOGY/BIOPROCESS TECHNOLOGY/FOOD BIOTECHNOLOGY)

PH.D. (TECH) (FOOD ENGINEERING AND TECHNOLOGY)

Research Scholar: Sachin K Sonawane

Research Supervisor: Dr. Shalini Arya

Studies on fruit based peptides and their application in food preservation

Bioactive peptides are well-defined protein fragments possessing antimicrobial, antioxidant, antithrombotic, anti-hypertensive, and immunomodulatory activities. Bioactive peptides are also known for their positive impact on the functioning or improving health conditions of living beings thus are emerging as health functional food. Today's consumers are becoming conscious about food safety; a growing concern of great importance world-wide. This is due to the fact that addition of chemical preservatives to food and its consumption is leading to certain health hazards resulting into a demand for more natural and minimal processed food. As a result, researchers have shown interest in natural antimicrobial agents such as plant and animal peptides. Plants and their products have been usually used for their potential nutraceutical properties which increases the consumption of seeds in diets. Exploration of inexpensive plant-based protein supplements, as well as developing new food products, has resulted in the investigation of the potential of underutilized dicotyledonous seeds (with

substantial traditional knowledge) for humans, as well as for livestock consumption. Considering all above concerns present research was aimed with following objectives:

- 1. Screening of fruit seeds and nutritional characterization:** Initially, screening of fruit seed were carried out on the basis of protein content. Watermelon, wood apple, custard apple seeds, tamarind seeds and jackfruit seeds were screened. Watermelon and wood apple seeds gave prominent results, and selected for further nutritional characterization such as centesimal composition, mineral and amino acid were carried out.
- 2. Optimization of method for protein extraction:** The effect of four independent variables viz. alkali concentration, buffer to sample ratio, pH, temperature, and extraction time on the protein yield was investigated. Each factor had an obvious effect on the protein content. One factor method was used to optimize the protein extraction parameters. The maximum total protein content achieved from watermelon was 903.1 mg/g of flour, which was obtained by optimizing extraction conditions such as alkali concentration (0.8%), temperature (40°C), time (30 min) and solid to

alkali ratio (1:30). However, in case of wood apple alkali concentration 0.8%, temperature 40°C, time 60 min, and solid to alkali ratio 1:20 resulted in a protein content of 924.31 mg/g.

- 3. Preparation of hydrolysates from fruit seed proteins:** Pepsin was effective in the hydrolysis of both watermelon and wood apple protein. Hydrolysis was measured by keeping degree of hydrolysis (DH) as response parameter. Box Behnken Design (BBD) was employed to optimize the hydrolysis parameters. For watermelon seed, maximum DH 39.30% was achieved at pH 2.4, an enzyme to substrate ratio 3% (w/w), and hydrolysis time 180 min was optimized using BBD. While for wood apple protein, DH was 39.82% at pH 2, ratio of enzyme to substrate (Es) was 2.5% (w/w), and hydrolysis time observed was 42.41 min, respectively.
- 4. Characterization of protein hydrolysate:** The present study details on antimicrobial characterization, thermal, structural, functional, and identification of protein in watermelon and wood apple seed protein hydrolysate. Both protein hydrolysates from watermelon and wood apple seed protein exhibited good antioxidant and antimicrobial activity. The

denaturation temperature for watermelon and wood apple protein hydrolysate was 71.84 and 92.28°C, respectively. The FTIR analysis showed presence of amide A type, amide I, amide III and amide VI band in both protein hydrolysates. The EAI of the watermelon and wood apple seed protein hydrolysate was 29 and 52.84 (m²/g). The ESI was found for both hydrolysates around 79%. LCMS profile showed presence of 4 proteins in wood apple and 29 proteins in watermelon.

5. Application of peptides in food systems:

Isolated anthocyanin's (Acs) are unstable and subject to chemical degradation and the degradation of ACs in aqueous solutions leads to a loss of color and biological activity. Oxygen, temperature, light, enzymes, pH, and food matrix composition, e.g., carbohydrates, proteins, acids, salts, sugars, and minerals are reported as effective parameters in degradation of AC. Hence we experimented to preserve the anthocyanin by using watermelon and wood apple protein hydrolysate. The degradation of anthocyanin added with natural plant protein hydrolysates from watermelon and wood apple followed first order of reactions. The most significant effect was observed with addition of 2% protein hydrolysate.

Research Scholar: Niral Shah
Research supervisor: Prof. Rekha S. Singhal

Biopolymer modifications for novel food applications

Biopolymers are ubiquitous in nature, and find numerous applications in a wide range of industries. Many of these biopolymers are amenable to physical or chemical modification to tailor physicochemical, mechanical and functional properties for desired applications. Hydrophobic modification of biopolymers by covalent incorporation of alkyl/alkenyl carbon chain in the structure has been an area of extensive research. Carboxylic acids, their derivatives and alkyl halides are used for this purpose. The abundant presence of certain chemical groups, for instance, hydroxyl groups in polysaccharides and amino groups in the primary structure of proteins, enable reactions with the above mentioned reagents. The introduction of apolar chains and charged groups in uncharged or already charged biopolymers lead to changes in structure and hence functional properties of the biopolymers. The present work was undertaken to study some of these aspects, with biopolymers being restricted to polysaccharides and proteins.

1. Hydrophobic modification of polysaccharides: polysaccharides were hydrophobically modified, evaluated for changes in properties and applications were developed therefore

as follows: i) n-Octenyl succinylated pullulan was synthesized and then used as edible coating of sapota fruit for extending its shelf life under ambient storage by studying biochemical and physical parameters. The developed polymer was compared to pullulan coating made with emulsified oil. ii) Synthesis, characterization and application of n-Octenyl succinylated guar gum (GG-OSA) as a dual-functional additive in bread and mashed potatoes was performed. GG-OSA with degree of substitution of 0.025 proved to be a potential replacer for diacetyl tartaric and fatty acid esters of glycerol as an anti-staling agent in bread, iii) Dual modification of maize starch by oxidation followed by esterification, structural characterization followed by studies on emulsification and microencapsulation of soybean oil was investigated. The starch was esterified by either using n-OSA or dodecyl succinic anhydride (DDSA). Oxidation and n-Octenyl succinylation of maize starch under the limits approved by JECF A for food use proved to be a potential replacer for gum Arabic for emulsification and microencapsulation of soybean oil. These results were obtained from the entrapment and encapsulation efficiencies, surface morphology and 18 weeks of study of oil retention in the microcapsules.

2. Modification of Pea Protein Isolate: Succinic anhydride, n-OSA and DDSA derivatives of pea protein isolates (PPI) were synthesized, structurally characterized and evaluated for changes in functional properties. These modifications improved the functionality of the proteins at certain pH. These derivatives were investigated as emulsifiers in eggless cake by evaluation of physical properties of freshly baked cakes. The hypothesis behind this study was to compare the effect of modified proteins versus a blend of emulsifiers on the quality of fresh eggless cake. PPI modified with succinic anhydride (PPI-SA) with 48.39% of lysine modification was the best among the derivatives as an emulsifier for eggless cake. The texture, cake rise and air cells of cakes containing PPI-SA were comparable to cakes containing soy protein and whey protein isolates.
3. Protein – polysaccharide interactions: the interactions between native and modified (succinylated, n-octenyl succinylated and dodecyl succinylated) pea protein isolates and polysaccharides (guar gum and CMC) at two protein: polysaccharide ratios (5:10 and 10:1) were evaluated on the functional properties such as solubility, emulsion stability, foaming capacity and stability at different pH (3, 5, 7, and 9). Oil holding and water holding capacities of the blends

were also evaluated. The increased negative charge in the modified proteins led to changes in interaction with the polysaccharides and hence influenced the functional properties. The higher proportion (5:1) of polysaccharide in the blend had profound effects on functional properties compared to the lower proportion (10:1).

4. Gelling profiles of OSA starch-hydrocolloid blends: the effect of gelling hydrocolloids on the gelling profile of n-octenyl succinylated maize starch was evaluated. Native or modified maize starch was blended with hydrocolloids such as gellan gum, xanthan gum, high methoxy pectin and low methoxy pectin to form gels (pH 3, 5, 7 using citric acid) and in the presence of sugar (20%, w/w). These gels were analysed for their texture profile in terms of hardness, cohesiveness and springiness. The negative charge in modified starch structure due to the half-ester led to changes in interaction with the gelling hydrocolloids which also possess negative charge. There were synergistic as well as antagonistic effects in the texture of the gels.

Research Scholar: - Sonali Gaikwad

Research supervisor: Dr. Shalini Arya

Chemistry and technology of cereal legume based Indian traditional food

Thalipeeth is an Indian unleavened flatbread made from multigrain bhajani flour with added spices and seasonings. Bhajani is a medley of cereals and legumes. Thalipeeth preparation requires a lot of time, skills and its quality deteriorates due to staling and microbial spoiling during storage. Hence, the present study was aimed at the optimization. Characterization, improvement in quality and inhibition of staling of Indian savoury flatbread (Thalipeeth).

1. Formulation and physicochemical characterization of bhajani: The main challenge in the preparation of bhajani flour is to achieve proper combination of cereals and legumes to provide good processability and overall acceptability to the final product i.e. thalipeeth. For the optimization of bhajani, criteria used were: dough properties and sensory evaluation. Farinograph studies showed 402 BU consistency indicating it is low gluten flour. Rheology studies on bhajani flour showed thixotropic behavior. XRD studies revealed that bhajani flour contained C-type of starches. Granular structure of starch was observed from SEM. Optimized bhajani formulation was suitable for good dough making. Rollability and overall acceptability parameters.
2. Standardisation of ingredients and process parameters for thalipeeth: Thalipeeth with

highest overall acceptability was successfully optimized by using ingredients; salt 4%, red chilli 4%, cumin seed powder 1%, turmeric 0.6%, onion 40%, ginger: garlic 1:2, coriander 6% and 35g dough ball rolled into 14cm thalipeeth sheet along with baking temperature of 1400 C for 1 min. optimized thalipeeth was high in protein with low in GI values (44) and high protein digestibility 64 (g/100g), SEM of thalipeeth revealed distorted and squeezed starch granules on the inner side of the thalipeeth crumb. Standardized thalipeeth showed better dough stickiness (30.20gm), dough strength (1.10mm/sec) and tear force (418g).

3. Effect of additives on quality improvement and evaluation of dough and thalipeeth: in the present study, effect of additives like hydrocolloids (guar gum, xanthan gum), polysaccharides (hydroxypropyl methylcellulose (HPMC)), emulsifiers (stearoyl-2 lactylate (SSL), glycerol mono stearate (GMS) and psyllium husk ranging between 0.25 to 1% on the quality of multigrain flour, dough and thalipeeth was evaluated. All the additives contributed significantly in the improvement of overall quality of dough and thalipeeth such as high extensibility (4.45mm), a significant increment in dough stickiness (36.87gm)

and cohesiveness (1.45mm/sec) as compared to other additives. The force required to tear thalipeeth was remarkably decreased with the addition of guar gum. The microstructure of thalipeeth with guar gum showed proper gelatinization of starch due to good moisture retention properties of dough which resulted in uniform texture of final product. Guar gum at the concentration of 0.75% w/w of multigrain flour gave the softest and attractive surface with highest overall acceptability. It remarkably improved rheological properties of dough and subsequently texture of flat bread product.

4. Inhibition of staling : Staling is the major problem associated with thalipeeth. For the inhibition of staling various approaches were employed viz., low-temperature storage. Frozen storage, par-baking. Staling of thalipeeth occurred both at room temperature and refrigeration temperature storage, however, the rate of staling was less at refrigeration temperature (4+0 C) than that at room temperature (29+1oC) storage. Frozen storage at -18oC of thalipeeth dough, ready to eat thalipeeth and partially baked thalipeeth significantly preserved the freshness by restricting staling process. Addition of additives (guar gum and GMS) significantly preserved quality of frozen

dough, par-bake as well as ready to eat thalipeeth. Amongst all the samples, ready to eat thalipeeth was most effectively preserved for the textural and sensory properties even after 45days of frozen storage.

5. Nutritional characterization of thalipeeth: effect of addition of ragi, pearl millet and barley flours at levels of 10, 20 and 30% in the optimized bhajani flour dough and thalipeeth was evaluated. The optimization of level was carried out on the basis of dough rheology, textural and sensory properties of thalipeeth. Thalipeeth containing 10% barely flour received highest sensory overall acceptability score. Physical characterization of barley thalipeeth for quality parameters such as dough stickiness. Color and tensile properties (tear force and extensibility) was carried out. Further nutritional characterization for proximate, bioactive constituents (total phenolic content, flavonoids, tannins and antioxidant activity), in-vitro glycemic index and in-vitro protein digestibility was carried out. Significant improvement in bioactive constituents such total phenolic content, flavonoids, tannins and antioxidant activity of thalipeeth containing 10% barley flour was observed.

6. PH.D. (TECH) (FOOD BIOTECHNOLOGY)

Research Scholar: -
Bincy Bhaskar

Research supervisor: Dr.
Laxmi Ananthanarayan

Studies on bioactive peptides from selected legumes commonly consumed in India

In recent years, it has been identified that dietary proteins can provide a rich source of biologically active peptides. Bioactive peptides remain inactive within the parent protein molecule and generally contain about 3-20 amino acid residues. Legumes are major protein sources in developing countries and are increasingly used as a substitute for animal proteins in developed countries. Thus, these legumes can be evaluated for their potential to generate ACE (Angiotensin Converting Enzyme) inhibitory and antioxidant peptides.

1. In silico studies: The globulin protein sequences of some legumes were retrieved from UniProt. These sequences were then processed for ACE inhibitory and antioxidant peptides using BIOPEP database. Analysis showed legumin protein from kidney bean and chickpea to be a potential source of ACE inhibitory and antioxidant peptides. Enzymes like proteinase k, pepsin, papain, ficain, chymotrypsin C and thermolysin showed maximum capability in generation of ACE inhibitory and antioxidant peptides from the selected proteins. The highest number of ACE inhibitory and antioxidant

peptides after three enzyme proteolysis (in silico) was found to be generated by conarachin of peanut and legumin of pigeon pea, respectively. This work can help in screening legume protein sequences to identify the potential precursors of bioactive peptides as well as in proteolysis simulation.

2. ACE inhibitory and antioxidant potential in seeds vs sprouts: Five legumes (hyacinth bean, moth bean, kidney bean, white pea and lentil) were taken for study. Effect of soaking, germination for 24 h, 48 h and 72 h as well as cooking after soaking on the free amino nitrogen content, ACE inhibitory and antioxidant activity of these legumes was investigated. Different treatments to legumes did not contribute significantly to ACE inhibitory activity though antioxidant activity of legumes was improved by it.

3. Studies on generation of ACE inhibitory and antioxidant peptides after In Vitro Protein Digestion (IVPD): In vitro protein digestion (IVPD) with pepsin, trypsin and chymotrypsin was carried out on the same five legumes with the same treatments. Free amino nitrogen content and solubility increased on IVPD. Also, ACE inhibitory activity and antioxidant potential increased in all treatments considered under study when compared to their non IVPD counterpart.

4. Effect of fermentation on production of ACE inhibitory and antioxidant peptides: Idli is a cereal-legume based

fermented food popular in India. Rice and black gram (3:1) was used for preparation of idli batter and alcalase enzyme was added to the batter in different concentration for 14 h. Changes in pH, titratable acidity, batter volume, viscosity, free amino nitrogen content, microbial count, ACE inhibition and antioxidant activity of the idli batter after treatment with alcalase were studied. Sensory analysis of the cooked idli was performed. Addition of alcalase in idli batter improved the ACE inhibitory and antioxidant activity and free amino nitrogen in the idli batter which could be due to hydrolysis of proteins into peptides. However, it affected the texture as well as bulk density to a certain extent when compared to control idli.

5. Effect of enzyme hydrolysis on the functional properties of horse gram: Alcalase enzyme was chosen for hydrolysis of whole horse gram to study the changes in functional properties after hydrolysate production. HG flour was mixed with water in the ratio of 1/10 (w/v) and alcalase added at E/S ratio of 1:10 (v/w) at pH 8.0 for different time periods. Degree of hydrolysis (DH) calculated by TNBS method showed that hydrolysis progressed rapidly with a decline in the rate subsequently by five hours. Different hydrolysates with different degree of hydrolysis were produced which were then checked for ACE inhibition, antioxidant activity, protein solubility, emulsifying and foaming properties. It was observed that all the properties except foaming improved with

increase in hydrolysis of whole horse gram flour by alcalase, particularly of HGH with DH 40%.

6. Purification and characterization of ACE inhibitory peptides: Horse gram hydrolysate showing highest ACE inhibitory activity (DH40) was chosen for further purification and characterization. It was purified by ultrafiltration, ion exchange chromatography, gel filtration and RP-HPLC to finally collect two peaks with highest ACE inhibitory activity with a retention time of 2.70 and 15.00, respectively. These two peaks were pooled and the peptides were characterized by LC MS/MS. 12 peptides were chosen based on their similarity to the ACE inhibitory peptides which have already been reported by other studies with the help of ACE inhibitory peptide databases. These peptides were then given for peptide synthesis and their ACE inhibitory activity was assayed. Two novel peptides were identified from horse gram hydrolysate with DH of 40%.

Research Scholar: - Shweta R. Deshaware

Research supervisor: Prof. Rekha S. Singhal

Studying the polymorphism in bitter taste receptor TAS2R38 in Indian Population and approaches to debittering bitter gourd juice

Bitterness is considered as the most aversive taste and shunned by most consumers. However, many bitter foods have bioactive compounds required for a

healthy nutritional status. The bitter taste receptor gene TAS2R38 is of great significance as it influences oral perception of various foods, has nutritional implications, and has shown association with various disease traits. Hence it is necessary to develop debittered versions of bitter foods with retention of bio-functional activities. The present work was undertaken to study the polymorphisms associated with TAS2R38 in healthy Indian population, and ii) formulated debittered bitter gourd juice with enhanced anti-diabetic potential.

1. Genetic and phenotypic variation of TAS2R38 gene in Indian population: A total of 393 healthy Indian adults were recruited for the study. Three polymorphic sites - rs713598, rs1726866 and rs10246939 were selected. Genotyping was done by polymerase-chain reaction-restriction fragment length polymorphism. Phenotyping was done using 6-n-propylthiouracil (PROP). Genotypic and phenotypic data suggested that Indian population had higher number of non-tasters than other population segments reported worldwide. BMI and food preferences neither significantly correlated with TAS2R38 genotypes nor with PROP taster status. Preference for umami tasting foods was observed.

2. Formulation of bitter gourd juice with enhanced bioactivity: E n z y m e

assisted extraction using pectinase was optimized using response surface methodology (RSM) for enhancing both the yield as well as the anti-diabetic potential of bitter gourd juice. The juices so obtained were also quantified for total and individual phenolics as well as the antioxidant profile. The optimized conditions increased the juice yield from 55% to 81.62 % (v/w), and also enhanced the α -amylase and α -glucosidase inhibition activity from ... to 22.80 and ... to 58.52%, respectively. An increase in the content of total phenolics ($p > 0.05$) and DPPH antioxidant activity from to 710 $\mu\text{g GAE/ml}$ and to 198 $\mu\text{g GAE/ml}$, respectively, was also recorded.

3. Debittering of bitter gourd juice: Triterpene glycosides momordicoside K and momordicoside L cause bitterness in bitter gourd. Attempts to reduce/mask bitterness of the same were successfully achieved on by addition of β -cyclodextrin (0.25% to 2%) along with taste modifiers such as stevia and lactic acid. The debittered juice so developed was evaluated organoleptically as well as for anti-diabetic and antioxidant profile. Addition of 1.5 % β -cyclodextrin to bitter gourd juice demonstrated highest score for sensory acceptability, higher total phenolic content and antioxidant activity, and anti-diabetic activity

at par with control juice. Investigations to study the effect at molecular level by NMR and FTIR indicated the formation of an inclusion complex. The debittered juice so developed was microencapsulated by spray drying using gum Arabic as wall material. The process parameters were optimized; the powder so obtained was reconstituted to contain similar amount of solids as in bitter gourd juice before spray drying, and evaluated as above.

- 4. Pasteurization of debittered bitter gourd juice:** A comparative evaluation of pasteurization by thermal vis-à-vis gamma irradiation was evaluated for obtaining the best pasteurization conditions (conforming with HACCP guidelines) for bitter gourd juice. Different time-temperature profiles and irradiation doses were tested and kinetic parameters – D and Z values were determined. Results indicated mild heat treatment at (65 °C, 204 s) was better than radiation and produced a microbiologically safe juice with retention of bioactivity and superior sensory qualities up to 3 months.

Research Scholar: Deepak Kadam

Research supervisor: Prof. S. S. Lele

Studies in extraction and characterization of a biomolecule from defatted

seedcake of *Nigella sativa* and *Lepidium sativum*

Black cumin (*Nigella sativa*) and cress (*Lepidium sativum*) which belong to the family of Ranunculaceae and Cruciferae respectively. These seed has received a considerable attention among researcher and consumers alike due to its functional health benefits associated with its consumption. Some of these health benefits include diuretic, anti-inflammatory, anti-bactericidal anti-hypertensive, antidiabetic, anticancer and antioxidant effects. Black cumin and cress seeds are a rich source of lipid, polyphenol, protein, dietary or soluble fiber. The lipids obtained from the black cumin and cress seeds are rich in thymoquinone (TQ) and alpha-linolenic acid respectively. After extraction of oil, it generates a residual cake as a by-product, which is the excellent source of biochemical compounds such as polyphenols, protein, dietary fiber, and carbohydrate. However, the majority of the biochemical compound has not yet been widely exploited for their value in human nutrition. Therefore, the present work undertaken to investigate the various biochemical compound, especially the bioactivities of polyphenolic, protein isolate as well as hydrolysate and their subsequent application.

- 1. Extraction and characterization of polyphenol and protein isolate from black cumin and cress seedcake:** The effect of independent

variable viz. such as ethanol concentration (%), extraction time (min), extraction temperature (°C) and sample to the solvent ratio (w/v) on phenolic content. Whereas, alkali concentration, buffer to sample ratio, time and temperature on protein content were investigated. Each factor had an obvious effect on polyphenolic and protein content extraction. The phenolic extract of both the defatted seed exhibit strong antioxidant and anti-inflammatory property. Further, the extract was characterized by LC-ESI-Q-TOF-MS/MS profiling and the results showed that the ethanolic fraction contains many important phenolics such as Kaempferol, Coumaroylquinic acid, p-Coumaroyl glycolic acid, Caffeic acid.

- 2. Studies on the effect phenolic compound as cross-linking agent in chitosan-based polymer:** The black cumin and cress seedcake phenolic extract, as compared to tannic acid (TA), was evaluated for its effect on the film-forming ability of chitosan. These films were evaluated for their tensile strength, elongation, water vapor permeability (WVP), type of bonding, color, surface morphology and in vitro antioxidant activity release profile. Changes in absorbance intensity by FTIR indicated structural modification. The DSC

thermograph indicated a change in the melting point. SEM showed smooth and homogeneous surface cross-section composite film. The films exhibit dose-dependent and time-dependent release of total polyphenols and antioxidant activity in the water, 50% ethanol, and 95% ethanol. These observations indicate a possible application of this seed polyphenol extract in active packaging based on the requirements of a particular packaging. This can help valorization of the black cumin and cress seedcake for dual functionality in films extensibility as well as nutraceutical appeal.

3. Fractionation and characterization of enzymatically hydrolyzed protein isolate under controlled condition:

In this study, protein isolate extracted from black cumin and cress seedcake was hydrolyzed with pepsin to obtain hydrolysates that were fractionated by membrane ultrafiltration into four molecular size fractions (<5, 5–10, 10–30, and >30 kDa). The pepsin showed efficient at reducing the native black cumin and cress seedcake protein into low molecular weight peptide, which indicated the abundance of < 5kDa fraction after the membrane ultrafiltration of protein hydrolysate. Both the protein hydrolysate with < 5kDa fraction exhibit excellent antioxidant property. The fraction

further characterized by thermal, structural and functional activity. In addition, LC-ESI-MS/MS analysis of < 5kDa fraction resulted in the identification of peptide with the biological property. The findings of the study suggest the alternative plant seed protein as a source of antioxidant bioactive peptides.

The protein hydrolysate fractions (<5, 5–10, 10–30, and >30 kDa) obtained from black cumin and cress seedcake was investigated for their potential as a carrier for curcumin because of their low solubility and instability in aqueous solution. The study reveals that 10-30 kDa fraction exhibit a higher hydrophobic interaction with curcumin which was confirmed by the Fluorescence spectroscopy. The curcumin-complex possess an enhanced functional and antioxidant activity, which suggested a possible utilization in food product formulation.

4. Synthesize an Ag nanoparticle (AgNPs) by a green biosynthesis approach from the seedcake waste:

In the present study, an attempt had made to synthesize a silver nanoparticle (AgNPs) in a spherical structure by using black cumin and cress seedcake waste. The seedcake waste showed a presence of phenolic acid, flavonoid and terpenoid, which were used as a

reducing agent to reduce silver to AgNPs. The AgNPs were characterized using scanning electron microscopy (SEM), DSC and Fourier-transform infrared spectroscopy (FTIR). The morphology and crystalline phase of the AgNPs were determined from X-ray diffraction (XRD) spectra and transmission electron microscopy (TEM). The spherical AgNPs formed were of 12 to 23 nm size with the face-centered cubic. The synthesized AgNPs exhibit good antibacterial properties against Gram-positive as well as Gram-negative microorganisms. A spherical AgNPs further evaluated for its effect on the film-forming ability of chitosan. These films were evaluated for their tensile strength, elongation, water vapor permeability (WVP). The result of this study encourages utilization of plant seed waste not only for synthesis of nanoparticles but also provides a utility to generated fruit waste to some extent.

PH.D. (SCI) (BIOTECHNOLOGY)

Research Scholar: Manvi Vernekar

Research Supervisor: Prof. Rekha S Singhal

Elucidating the gene-diet-disease interaction of polyunsaturated fatty acid metabolism

Nonalcoholic fatty liver disease (NAFLD) is the accumulation of lipids in the liver without significant history of alcohol consumption. Sedentary lifestyle, dietary habits, genetics and gut microbiome are major risk factors for NAFLD.

Association of FADS and PNPLA3 gene polymorphisms with NAFLD: A total of 230 (113 NAFLD cases and 117 controls) were recruited for the study. SNPs of FADS1 rs174547, FADS2 rs3834458, FADS2 rs66698963 and PNPLA3 rs738409 were selected. Genotyping was done by polymerase chain reaction-restriction fragment length polymorphism. BMI of cases was significantly higher than controls. Subjects carrying G/G genotype of rs738409 had 3.31 times greater odds of having NAFLD ($p=0.006$ OR 3.31 95% CI 1.41-7.71). T/del genotype carriers of rs3834458 were 2.04 times more likely to have NAFLD ($p=0.05$, OR 2.04 95% CI 0.99-4.17) after adjusting for confounders.

Association of Polyunsaturated fatty acid (PUFA) biomarkers with NAFLD: Plasma PUFA analysis was carried out in a sub-group of NAFLD subjects and healthy controls. PUFA dietary intake was assessed by

a food frequency questionnaire. Plasma total fatty acids were extracted and transesterified to fatty acid methyl esters (FAME). The FAMES were later analysed by GC-FID. Plasma levels of eicosapentaenoic acid (EPA) ($p<0.01$), γ -linoleic acid (GLA) ($p<0.05$) and delta-6-desaturase enzyme activity ($p<0.05$) were significantly reduced in NAFLD cases as compared to controls. Ratio of n-6/n-3 PUFA intake was 9.25 in controls and dramatically higher at 12.16 in cases.

Gut microbiome characterization in subjects with nonalcoholic steatohepatitis (NASH) vis-à-vis healthy controls: Stool samples from NASH patients and controls were collected. DNA extraction was carried out followed by 16s rRNA gene amplification. Ion-torrent next generation sequencer platform was used for sequencing. Pre-processing and analysis of sequences was carried out by Mothur v1.38.1. Biodiversity estimates gave variation in clustering with respect to relative abundance implying dysbiosis. NASH subjects had significantly elevated levels of Streptococcus and C. ramosum while healthy controls had higher abundance of Ruminococcus.

In conclusion, this study elucidates a **novel relationship** between FADS gene polymorphisms, plasma PUFA levels, D6D enzyme activity, gut dysbiosis and the increased risk of NAFLD.

M. TECH. (FOOD ENGINEERING &

TECHNOLOGY)

Research Scholar: Cheryll Fernandes

Research Supervisor: Dr. S.S.Arya

Development of Multi-Grain functional beverage

There is a growing interest seen among consumers towards more health conscious and wholesome nutrition. Whole grains may be processed efficiently and innovatively to create products that would be considered as healthy. In view of this, a multigrain functional beverage was sought to be developed using whole grains like barley, oats, buckwheat and red rice. Multigrains that contain whole grains are rich in complex carbohydrates (starch and fiber), B vitamins and minerals like magnesium and iron. The complex carbohydrates, specifically soluble fiber, help in the slow and sustained release of energy whereas the B-vitamins and minerals facilitate metabolism. Whole grains are also plentiful in phenolic compounds which have antioxidant capacities. The objective was to develop a great tasting beverage rich in soluble fibre and total phenolics. The optimum ratio of grains to make the multigrain beverage was obtained using mixture design. The grains were varied between 3-5 g, 3-5 g, 2-4 g, and 0-2 g of barley, oats, buckwheat and red rice respectively and best ratio was selected based on sensory acceptance, soluble fiber content and phenolic content. In order to improve the mouthfeel and sensory acceptance, the beverage was treated with alpha-

amylase enzyme. Additives such as FOS, gellan gum and natural flavors were also added to improve the quality of the beverage. FOS improved the taste of the beverage and increased its soluble fibre content. Gellan gum provided stability to the beverage and the natural flavours increased the total phenolic content while enhancing the sensory appeal of the beverage. Thus, by using the four grains viz., barley, oats, buckwheat and red rice along with suitable additives, a healthy beverage was developed that provided atleast 10% of the soluble fibre recommended for daily intake and up to 108.7mg total polyphenols per serving (200 ml).

Research Student: Vrushti Shah

Research Supervisor: L. Ananthanarayan

To study the effect of cereal flour ingredients on rheological & tectural

Traditional foods are foods in which knowledge about a particular region, community or country is transferred across generations. Deep fat fried and shallow fried food products are an integral part of our Indian food cuisine. Dhirde is a flat, circular pancake prepared by mixing different cereal flour ingredients with spices and condiments and considerable amounts of water to get a thin batter like consistency. An initial study was undertaken to optimize the water addition suitable to prepare a batter of thin consistency with varying proportions of refined wheat

flour (RWF): whole wheat flour (WWF). 1: 4 (w/w) RWF: WWF with 1: 2.25 (w/v) flour mixture: water ratio was optimized for further studies. Addition of maize and sorghum flour were individually varied from 0 to 100% (w/w) in flour mixture made of 1:4 RWF: WWF (w/w) and water addition for preparation of batter was varied from 1:2.25, 1:2.5 and 1.2.75 (w/v) flour mixture: water ratio. 50% maize flour incorporation (w/w) with 1:2.5 (w/v) flour mixture: water ratio was optimized for dhirde preparation. Similarly 50% sorghum flour (w/w) with 1: 2.50 (w/v) flour mixture: water ratio was optimized for dhirde preparation due to its excellent film forming ability and texture. Rice flour was incorporated from 1 to 5% w/w into RWF+WWF mixture with different water additions (1: 2.25 and 1:2.5 w/v). 3% (w/w) rice flour incorporated flour mixture with 1: 2.5 (w/v) flour mixture: water ratio was optimized. Dhirde batters were subjected to rheological testing from 0.26 to 1.59s⁻¹. Dhirde batters showed non-Newtonian shear thinning behavior with 'n' values ranging from 0.019 to 0.524 and fitted best in power law model. The rheological properties of the batter and the textural properties of dhirde were

impacted with proportions of different cereal flours possibly because of differences in chemical composition and functional properties of flours. This basic approach undertaken on cereal batter

based pancakes- dhirde is an attempt to understand the science behind the preparation of traditional foods. A separate study was carried out to evaluate the effect of added ingredients on deep fat fried ribbon pakoda. Ribbon pakoda is a customary south Indian deep fried snack prepared from chickpea flour and rice flour with added spices and condiments to which a suitable amount of water is added to prepare soft dough which is then extruded onto hot oil and fried. Initially, with 50:50 (w/w) chickpea flour: rice flour ratio 1:0.6 (w/v) flour mixture: water ratio was optimized to obtain a soft dough of desirable consistency. By varying chickpea flour: rice flour ratio, water addition was optimized for each flour combination (50:50 to 30: 70 w/w). 1:0.65 (w/v) and 1: 0.7 (w/v) flour mixture: water ratio was optimized for 40: 60 and 30: 70 (w/w) chickpea flour: rice flour ratio respectively. Keeping flour mixture: water ratio at 1:0.7 (w/v) chickpea flour: rice flour ratio was varied from 70: 30 to 30: 70 (w/w). 30: 70 (w/w) chickpea flour: rice flour ratio gave excellent results in terms of product texture and therefore, was optimized. Roasted chickpea flour was incorporated from 1 to 100% (w/w of chickpea flour) by replacing raw chickpea flour in the optimized flour mixture. 60% (w/w of chickpea flour) incorporated roasted chickpea flour was optimized on the basis of the product's crispness and overall acceptability. It was also observed that with increase in dough resting time there was a decrease in the L*(brightness)

and b^* (yellowness) values of the deep fried product while there was an increase in a^* (redness) value. This observed increase in redness of the fried product with increase in dough resting time correlated with the increasing reducing sugar content in the dough which is likely to have promoted Maillard browning reaction. Such a basic study on ribbon pakoda a popular south Indian traditional snack is the first of its kind to be reported. Overall the work undertaken on two traditional food products has used a fundamental exploratory approach to understand the effect of added flour ingredients varying in chemical composition and functional properties on the batter/dough properties and on the textural properties of the ensuing product.

Research Student: Bulbul Vij
Research Supervisor: U. S. Annapure

Studies on effect of cold plasma treatment on commercial gums

Xanthan gum is an anionic heteropolysaccharide, produced by *Xanthomonas campestris*, consisting of repeated pentasaccharide units formed by two glucose units, two mannose units and one galacturonic acid with the molar ratio of 2.8:2.0:2.0. The main chain consists of β -D-glucose units linked at the 1 & 4 positions & side chain (trisaccharide) linked at O-3 position. Many gums suffer from various deficiencies such as low solubility, poor thermal stability and low mobility of its solutions, which have markedly limited their

applications. Thus, gums are required to be modified in order to alter their physico-chemical properties by modification through derivatisation of functional groups, grafting with polymers, cross-linking with ions etc. However, modifications by chemical methods have some limitations such as presence of harmful residues within the final product due to the used chemicals. Therefore, a non-chemical method such as Cold Plasma treatment can also be used for modification of gums which is Safe i.e., no formation of any harmful residues, effective at ambient temperature and has minimum effects on nutritional & sensory quality parameters of foods.

Xanthan gum was modified by using cold plasma treatment with different time-power combinations. Cold plasma treatment does not significantly affect the proximate composition of xanthan gum. However, loss of water in all samples might have taken place due to vacuum system which sucks the surface moisture. Significant decrease in bulk density, tapped density and hausner ratio, compressibility index, angle of repose and significant increase in porosity of xanthan gum in all plasma treated gums indicates increase in surface roughness as well as surface area to volume ratio of xanthan gum after the plasma treatment. Increase in oil holding capacity (OHC) might be due to increase in surface area of xanthan gum after plasma treatment. Plasma treatment results in decrease

in pH and an increase in acid value which might be due to the reaction of chemical species with surface moisture resulted in formation of acids. Increase in surface area after cold plasma treatment was well confirmed by BET analysis. No change in crystalline structure of xanthan gum was found after cold plasma treatment. Xanthan gum is made up of mannose, glucose and glucuronic acid units. After plasma treatment, no significant changes were found in composition of sugars in xanthan gum except glucuronic acid which increases with treatment power as well as exposure time after plasma treatment as confirmed by increasing acid value and decrease in pH with increase in treatment power as well as exposure time. No significant changes were found in emulsion capacity after plasma treatment because xanthan gum itself has excellent emulsifying properties. However, significant differences were found in emulsion stability of oil/water emulsions prepared by untreated and cold plasma treated xanthan gum under different conditions such as sucrose, fructose, salt and at different pH values.

A change in specific rotation of xanthan gum after cold plasma treatment confirms changes in its molecular confirmation. Plasma treatment resulted in increasing viscosity in plasma treated xanthan gum samples compared to untreated xanthan gum at specific power and time combination. Significant changes were found in zeta

potential values and surface tension after plasma treatment. After the plasma treatment, no change in basic spectra was observed by FTIR. Cold plasma treated xanthan gums when used in preparing gels in combination with other galactomannans such as locust bean gum results in no significant differences in texture profile analysis except in hardness and adhesiveness values of gels. Use of cold plasma treated gums at all power and time combinations resulted in decreasing oil uptake ratio as compared to untreated xanthan gum used in the frying of sev. Therefore, plasma treatment can effectively be used to modify the physico-chemical properties of gums and is a safe and effective method for the modification of gums.

Research Student: Aroshi Sharma

Research Supervisor: U. S. Annapure

Studies on isolation and physiochemical characterization of plant gum exudates

Plant gum exudates are important polysaccharides with wide range of applications in food as well as other industries. The objective of the study was to isolate, purify and investigate physico-chemical properties of plant gum exudate derived from *Acacia catechu* and *Prunus domestica* trees. Plant gum exudates were collected from district Solan and Shimla of Himachal Pradesh. When the plant was subjected to stress, it produced gum by the process

of gummosis. The purification of collected gum exudates was done by employing alcoholic precipitation. The gums were characterised for its proximate, physicochemical, functional, rheological and thermal properties.

Acacia catechu tree is cultivated for "kattha" in different parts of the country. The exudate from *Acacia catechu* (ACG) was compared with commercial gum acacia (CAG) for its various physicochemical and functional properties. The protein content of ACG was higher than CAG, thereby, ACG possessed better emulsifying properties than the commercial one even at low concentrations. The proximate content of ACG meet the regulatory specifications set by JECFA for acacia gum. The results of monosaccharide composition of *Acacia* exudates indicated the presence of arabinose, galactose and rhamnose. FTIR spectra revealed the insignificant differences in the functional groups of both gums. The comparative assessment of the rheological properties of both the gums showed similarities in the viscosity profile. Thermal stability of ACG was lower than CAG. The film forming capacity of the both the varieties was examined and it was found out that thin films can be formed using ACG with properties comparable to CAG. Based on the properties, comparative study was conducted to assess the microencapsulation efficiency of ACG and CAG. The physical

properties of the encapsulated powder were analogous whereas better encapsulation efficiency of ACG was observed. It can be concluded that, the properties of ACG showed a good resemblance with CAG and can be used as substitute for numerous applications in food and pharmaceutical industry.

Prunus domestica is the one of species of Rosaceae family which is widely cultivated for plum in northern part of the country. The gum exhibit soluble (73%) and non-soluble fraction (27%). FTIR spectra of crude, soluble and non-soluble fraction of the gum did not show any differences in the type of functional groups present. XRD analysis of these fractions showed that the crystallinity index of the non-soluble fraction was higher than soluble fraction. The non-soluble component contained higher inorganic content than the crude and soluble fraction. The sugar composition of *Prunus domestica* gum (PDG) exudate revealed that it is an arabinogalactan with arabinose, galactose, xylose and rhamnose as important constituents. The water absorption capacity of soluble purified fraction was about 8.42 times to that of the weight of the gum. The DSC curve revealed the first endothermic transition at 92°C and 254.22°C as the degradation temperature. The emulsions were stable at higher concentration of salt and sugars, whereas loses its stability at low concentrations. Extreme pH (3

and 9) was also unfavourable for the emulsions. The viscosity of gum increased with increase in gum concentration which is in contrast to that of commercial gum acacia that exhibit low viscosity profile. Response Surface Methodology was used to evaluate the effectiveness of the gum in oil uptake reduction in sev as a function of time, temperature and gum concentration. The actual results obtained using the predicted variables showed less than 5% variation than the predicted solution, indicating the validation of optimized process parameters. It can be concluded that the properties of PDG makes it a potential additive that can be used for numerous applications in food and pharmaceutical industries.

Research Student: Vardan Singh

Research Supervisor: S. S. Lele
Studies on Rosella and its food applications

There have been claims on medicinal benefits and functional properties of roselle (*Hibiscus sabdariffa* L.). The main purpose of this study was characterization and aqueous extraction of roselle, development of mixed fruit and vegetable beverages in combination with roselle and utilization of roselle in rice extruded products as a source of colorant and antioxidant. The result shows that proximate composition of roselle mainly constituted by carbohydrates 68.2±0.16 % and appreciable amount of ash content 12.1±0.08 %. The physicochemical and

biochemical properties of roselle included color ($L=42.96 \pm 1.97$, $a= 67.35 \pm 1.68$, $b= 49.34 \pm 2.74$) and titrable acidity of 18.09±0.36%, ascorbic acid (mg/100gm) of 85.28 ± 1.39, total phenols of (mg GAE/100gm) 29.46 ± 1.16, GAEAC (mg/100gm) of 34.90 ± 1.42 and anthocyanin (mg/100gm) of 443.65 ± 17.89. However these bioactive compounds can be destroyed in extraction of roselle. Therefore, in the aqueous extraction study, the effects of different extraction methods, namely hot water,

ambient water and boiling water extraction on the changes in anthocyanins, phenolic compound and antioxidant activity were evaluated. Result indicates that the hot water extraction method (65°C & 3hrs.) was the most effective extraction method.

The purpose of using central rotatable composite design (RCCD) for clarification of banana, pineapple and watermelon juices was to optimize the process variables, enzyme concentration, incubation time and temperature which affects the yield of the juice. The optimum condition was enzyme concentration of 0.13% (pectinase), 0.13% (pectinase) and 0.05% (cellulase), temperature of 42.9°C, 41.97°C and 40.28°C, and time of 140.16, 139.44 and 40.08 min. for pineapple, banana and watermelon juices respectively with a yield of 71.46%, 60.38% and 81.16% respectively.

Sensory analysis (9 point hedonic scale) was conducted to determine the blending ratios of fruits and vegetable juices in beverages. For the sensory analysis different blending ratios (50:50, 60:40, 70:30, 80:20, 90:10 and 100:0) were prepared. The optimized blending ratios based on sensory analysis were 80:20, 80:20, 50:50, 70:30 and 60:40 respectively for pineapple-cucumber, pineapple-ash gourd, roselle-watermelon, roselle-banana and roselle-ash gourd beverages. All the beverages were analyzed before and after pasteurization for their color, brix, acidity, pH, ascorbic acid, phenolic compound, antioxidant activity and flavonoids content. All five developed beverages were pasteurized at 95°C for 15 min. in 200ml crown corked glass bottles and stored at room temperature (27±3°C) to check their shelf stability. From the shelf life study of the beverages, it was found that the microbial load was within safe limit after 90 days of storage at room temperature. Significant loss on bioactive compound were found with in storage period. Twin screw extruder was used for the extrusion of rice flour enriched with roselle powder. Three factor box behnken design was applied for the optimization of process parameters which were barrel temperature (120°C-180°C), feed moisture (14-18%) and roselle powder content (1-5%). And phenolic content, anthocyanin content, antioxidant activity, expansion ratio and breaking strength of the extrudates were measured. Loss of phenolic compounds and

antioxidant activity was lower at 120°C and 180°C than at 150°C. While the loss of anthocyanin was found minimum at 120°C and maximum at 180°C. At low temperature (120°C) and high moisture content (18%) expansion ratio was minimum and breaking strength was maximum. At high temperature (150°C to 180°C) and low moisture (14%) expansion ratio was high and breaking strength was minimum. With the increase in concentration of roselle powder expansion ratio was found significantly decreasing.

Research Student: Swarnali Das

Research Supervisor: L. Ananthanarayan

Studies in the development of healthfull fruit beverages

India is the second largest producer of fruits and vegetables in the world. Fruits and vegetables play an important role in one's diet because of the abundance of nutrients such as vitamins, antioxidants and minerals. Due to seasonal nature of fruits, poor keeping quality, improper handling, storage, transportation, marketing and processing, a huge amount of post-harvest losses occur. In order to improve the nutritional status of the people and also to benefit growers and consumers, there is a need to process and preserve them in the form of pulps, juices and beverage. Fruit pulps/ juices and their beverages are easily digestible, highly refreshing, appetizing, and nutritionally far superior to synthetic and aerated drinks available in the

market. Mixed fruit beverages are obtained by blending two or more, appropriately selected fruit juices combined in varying proportions which make exotic and seasonal fruits readily available to consumers, throughout the year. Moreover, blending is the best way for the judicious use of under-utilized yet high potential, indigenous fruits, which are generally discarded or overlooked owing to their very low total soluble solids (TSS), excessively strong flavor, high acidity, astringency and bitterness. An attempt has been made to utilize underutilized yet nutritious fruits like carambola, amla and fig by making single and mixed fruit beverages. For that, first the enzymatic process parameters have been optimized for amla and fig juice extraction by rotatable central composite design considering yield and Total soluble solid as responses. The optimized enzymatic extraction process parameters were: enzyme concentration (0.35 v/w%), incubation temperature (37.4 °C), incubation time (1.3 hr.) and added water content (11.3 v/w%) for amla juice using pectinase enzyme and enzyme concentration (0.15 v/w%), incubation temperature (45 °C), incubation time (90 mins.) and added water content (12.5 v/w%) for fig juice using cellulase enzyme. The enzymatic process parameters had significant effect on the yield of juice but had least effect on the total soluble solid portion of the juice. Pectinase treatment increased the yield of amla juice by 43.5% and cellulase

treatment increased the yield of fig juice by 29.5%. Six beverages among which three were single fruit beverages (amla beverage, carambola beverage and fig beverage) and rest three were mixed fruit beverages (amla-fig beverage, carambola-fig beverage, carambola-amla-fig beverage) have been formulated. The formulation of mixed fruit beverages was optimized by using mixture design taking sensory attributes and bioactive components as responses. The six beverage formulations included: amla beverage (% amla juice : 14), carambola beverage (% carambola juice : 100), fig beverage (% fig juice : 40), amla-fig beverage (amla : fig : water :: 6:17:27), carambola-fig beverage (carambola : fig : water :: 32:34:34) and carambola-amla-fig beverage (carambola : fig : amla :: 25 : 15 : 6). These six formulated beverages were acidic in nature but organoleptically well accepted. The nutritional characterization of these beverages before and after thermal treatment showed that the beverages were rich in vitamin C, antioxidants and polyphenols. The thermal treatment of the beverages was done at 90 °C for 20 minutes with addition of sodium benzoate as preservative to ensure microbial safety and increase the shelf life. Though thermal treatment ensures microbial safety it degrades nutritional components especially bioactive components like vitamin C; in this study vitamin C degradation occurred by 35-41% due to thermal processing of the beverages. The other bioactive

components decreased by 20-30%. Different LAB strains were added in the formulated single and mixed fruit beverages to check their survivability for a certain period of time in order to develop probiotic beverage. Among that strains, *Lactobacillus plantarum* NCIM 2084 survived up to 21 days and *Lactobacillus helveticus* NCIM 2733 strain survived up to 42 days in both single and mixed fruit beverages. The addition of dried ground fruit pomace (1.2%) into the formulated single beverages and mixed pomace (1%, containing all three fruit pomaces in equal proportion)) in mixed fruit beverage also showed good sensory attributes and enriched

the beverages with dietary fibre. During storage, significant amount of loss of bioactive components occurred. The average vitamin C loss in all beverages was more than 50%. For antioxidants and polyphenols, it was 57-60 % and the average amount of anthocyanin degradation was 38-50 %

Research Student: Divya M

Research Supervisor: S. S. Lele

Studies on development of functional flat bread incorporated with flaxseed

Functional foods provide physiological benefits like health promoting or disease-preventing properties beyond the basic function of supplying nutrients. Unfortunately, India has become the capital country for diabetes, cardiovascular diseases and obesity. Flaxseed (or

linseed) (*Linum usitatissimum* L.) is a rich source of α -linolenic acid, soluble and insoluble fiber and lignin. All these are having several health benefits like prevention of cardiovascular diseases, diabetes mellitus, colon cancer, hypertension, obesity and constipation. India is among the largest producer of flaxseed in the world. Varieties of flat breads are prepared and consumed across India. Chapatti is one such Indian unleavened flat bread consumed by all Indians as staple food for lunch and dinner. Hence, to fortify a product with flaxseeds, flat bread will be a smart choice. Also, these are consumed usually in fresh form as it stales at a faster rate. An effort was made to develop flat bread with incorporation of flaxseed flour and to improve the storage quality of flaxseed incorporated unleavened flat bread.

Initially, rheological properties of dough were studied by varying the level of flaxseed flour from 0-35%. Process parameters like resting time, baking time and ingredients were optimized by varying one factor at a time. Sensory evaluation and texture studies revealed acceptability of flat bread with upto 20% roasted flaxseed flour. Further, to improve the storage quality of flat bread, effect of various additives viz. hydrocolloids (GMS, maltodextrin), enzymes (α -amylase, xylanase) and gums (xanthan gum, guar gum) were studied on optimized flat breads. Additives were incorporated at varying levels (0- 2%) to the dough and their effects

were evaluated by carrying out subjective analysis of dough quality and also sensory studies at regular intervals. The results showed addition of additives have positive effect on the quality of the flat bread. Optimized levels of each additive were further compared for its moisture retention ability, watersoluble starch content and In-vitro enzyme digestibility. Results showed that xylanase at the level

of 200ppm gave the best storage stability on incorporation in flat bread. It was also found that addition of xylanase and vacuum packaging showed synergistic effect in prolonging the shelf life of the product. On comparing storage at 30°C and 4°C, storage at refrigeration condition showed better shelf stability during 15 days storage. Nutritional and functional characterization of optimized flat bread was carried out and it was found that total dietary fiber content was increased from 8 to 12% in 20% flaxseed incorporated flat bread. In vitro protein digestibility reduced from 75.6 g/100g to 68.5 g/100g in the optimized product. Optimized flat bread was of low Glycemic Index (47.1) category. Antioxidant activity and total phenolic content was improved in 20% flaxseed incorporated flat bread.

Research Student: Niharika Soni

Research Supervisor: R. S. Singhal

Modification of guar gum using clodecerul succinic anhydride

Biopolymers are produced by living organisms for their structural integrity, protection, physiological functions or as reserve energy. The inquisitive human nature, ever-growing demands, and resources at disposal have led to copious research in the field of biopolymer modifications. The availability of reactive sites on these biopolymers makes them suitable substrates for esterification, etherification, oxidation, epoxidation, N-acylation, alkylation, etc. Dodecyl succinic anhydride (DDSA) is an esterifying agent that introduces a 12-carbon hydrophobic chain in the structure of the substrate containing suitable reactive sites. The use of DDSA as a modifying agent for biopolymers dates back to the mid-twentieth century and continues till date for improved functionality. These modifications are aimed at catering the needs of the paint, pharmaceutical, cosmetic, food, and textile industries. In many cases, for food applications, esterification is used for hydrophobically modifying the hydrocolloids. Starches, gum karaya, gum kondagogu, gum Arabic, alginate, inulin, cellulose have been successfully esterified with DDSA. In this study, an attempt was made to esterify guar gum (GG) and guar gum hydrolysate (GGH) with DDSA of which GGH was successfully modified. The esterification DS was optimized at 0.0289 and at 45°C with a reaction time of 2 h and with 3% w/w per 20g of GGH, using 0.5g NaHCO₃ as reaction facilitator and 90%

ethanol as the reaction medium. The DSC scans showed little difference indicating marginal degradation at polymeric level. Modified GGH was studied for its emulsification and microencapsulation properties. This modification introduced emulsification property to GGH. The particle size and viscosity of the emulsion so obtained was in the desirable range, making it suitable as a wall material for encapsulation. The modified GGH was able to encapsulate and retain soyabean oil without the aid of gum Arabic during five-week storage study. The encapsulation efficiency of GGH- DDSA was higher than that of GGH modified with n-octenyl succinic anhydride (GGH-OSA), but not as good as gum Arabic. In particular, GGH-OSA and GGH-DDSA could open up avenues in value addition of this important bioresource as a promising alternative to gum Arabic for microencapsulation of sensitive food components.

Research Student: Ashwini Kumar

Research Supervisor: R. S. Singhal

Studies on oleogels: formulation functionality & its application

Over the past few decades, there have been great advances in our knowledge of dietary fatty acids and their effect on human health. In particular, the suspected deleterious effects of trans and saturated fatty acids have been well documented. In this work, oleogels were prepared using flaxseed oil (FSO), olive

oil (OO), and rice bran oil (RBO) as base material and ethyl cellulose (EC), sorbitan monostearate (SMS) and kokum fat as gelator. Peroxide value of oleogels was monitored by addition of butylated hydroxyl toluene (BHT). Mixture design was applied to optimize the formulation by balancing the properties of the oleogels, viz. firmness, adhesiveness, cohesiveness and springiness. Optimized concentrations of the gelators for oleogels from FSO, RBO, OO oleogels at 30°C were i) 3:1 combination of EC:SMS at 7.6%, 8%, 7.5%, respectively, and ii) kokum fat at 12.39%, 12%, 11.0%, respectively. Optimized oleogels were stable up to 45°C when exposed for 30 min. The optimized gelator concentration for FSO based oleogels were i) combination of EC:SMS at 3.86% and ii) kokum fat at 16.84%. From the phase diagram, it was found that kokum fat showed a synergistic effect with the combination of EC:SMS. Effect of oil type was studied at same concentration of EC:SMS and kokum fat at 8% and 12%, respectively, for all oleogels. The hardness of the oleogels was in the order of FSO > RBO > OO. FSO, RBO and OO based oleogels were stable and showed a peak temperature of 68.3°C, 71.94°C and 66.84°C, respectively, in DSC. FSO, RBO and OO optimized oleogels showed shear thinning behavior. FSO and OO oleogels showed a higher storage modulus than the loss modulus, and a viscoelastic behavior as seen from the cross over point in these gels. RBO oleogel showed a higher storage

modulus than loss modulus but no cross over point indicating its elastic behavior. All the three oleogels were amorphous in structure as evident from a single broad peak in XRD analysis. The peak positions and spacings of all oleogels diffractograms closely matched with each other. Molecular interactions amongst the oleogel components were studied by FT-IR studies; the position and d-spacing of the major peaks were conserved in the oleogels. This suggested that the polymorphic form of EC was not altered during the formation of oleogels. All the three oleogels had better stability at 5°C compared to 28 ± 2°C in terms of hardness, adhesiveness, cohesiveness, peroxide value and syneresis. Optimized RBO oleogel was evaluated as a replacement for bakery shortening in cookies at 25%, 50%, 75% and 100% followed by textural analysis of the dough as well as the cookies as well as sensory analysis of the cookies. The extent of curcumin transfer from oleogel to simulated intestine fluid (SIF) was measured for the RBO based oleogel- with and without 0.5% tween60 in SIF. A significantly lower extent of curcumin transfer in SIF was observed as compared to SIF with 0.5% tween60.

M. TECH. (FOOD BIOTECHNOLOGY)

Research Student: Shraddha Sontakke

Research Supervisor: R. S. Singhal

Non-conventional plant growth regulators

Non-conventional PGRs are naturally synthesized compounds from microbes and plants. Microbial volatile compounds like acetoin and 2,3-butanediol and plant secondary compound such as TRIA can substitute synthetic PGRs which are hazardous for human health and environment. TRIA is present in alfalfa, sugar cane and in tea leaves in form of cuticle wax. Just nanomolar concentration of TRIA is sufficient for plant growth. TRIA itself does not interfere in plant growth and development until it is incorporate in-vitro in plants. Similarly, microbial volatile compounds can also be added externally in plants.

In this study, TRIA was isolated from green tea leaves using Soxhlet extraction and SC-CO₂. As TRIA is present in green tea leaves in free and bound form (bound with palmitoyl ester), Soxhlet extraction was performed, with untreated green tea leaves and with alkaline (CaO) treated green tea leaves. The yield obtained with conventional Soxhlet extraction was compared with yield obtained with SC-CO₂. Theoretical modeling was done to calculate solubility of TRIA in SC-CO₂. The solubility parameters of TRIA and CO₂ were calculated using Hildebrandt solubility equation and were validated with experimental results. Theoretically, pressure had significant effect on extraction of TRIA. However, increased temperature enhanced the extraction further. A maximum extraction of TRIA 508.61±

24.35 mg/kg was obtained after SC-CO₂ extraction at 400 bar, 60°C and with extraction time of 180 min in comparison with Soxhlet extraction 141.95±0.00 mg/kg and 179.13±0.00 mg/kg were obtained without and with alkali treatment, respectively. TRIA was used as a PGR for spinach tissue culture at different concentration from 1.1 nM, 2.2 nM, 3.5 nM, 5 nM, 1.1 µM and 2.2 µM. 5 nM TRIA gave best results in terms of length of the plant and the number of leaves. Results were compared with synthetic PGR i.e. IAA at 100 µM. A maximum dry weight of plant was observed in 2.2 µM TRIA containing medium. Chlorophyll and carotenoid content were maximum in spinach treated with 100 µM IAA.

Research Student: Deepanshu Garg

Research Supervisor: J.S.Gokhale

Development of functional food ingredients using prosopis cineraria

Prosopis cineraria is the botanical name of the khejri. It belongs to Fabaceae family (leguminous family). Prosopis cineraria is especially cultivated in western and southern Asia including Afghanistan, Iran, India, Oman, Saudi Arabia and Pakistan. It has 15.78% protein, 3.5% oil and 72.46% carbohydrates. Prosopis cineraria seeds have good protein (23.23%) and oil (9.93%) content. Also, oil characteristics of Prosopis cineraria seed oil found are comparable with the other legumes. Being a famine

food, *Prosopis cineraria* pods and its various fractions exhibits good anti-oxidant properties which are comparatively more than the commercial legumes. It is found to be a comparable amount of tannins as compared to the other (88 mg/100 g). SPC (sangri protein concentrate), from sangri seed flour, with a recovery of 40% of total protein content was prepared by using one factor optimization method. SPC found to have good anti-oxidant properties as well as low content of anti-nutritional factors but, SPC exhibits poor foaming and emulsifying properties. Also, gelation of the SPC was not observed from a concentration range of 1% to 20%. Molecular weight of SPC was calculated by SDS-PAGE analysis 26.5 KDa (approximate value) with a IVPD value of 62%. SGI has found to have good emulsifying and hydration properties. It has superior water holding capacity than other *Prosopis* exudates and few commercial additives. SGI exhibited good anti-nutritional potential like significant potential of antioxidant and high content of soluble dietary fibers.

Research Student: Sanjogita Gosavi

Research Supervisor: S.S. Arya

Studies on fermented functional novel flat bread: Kulcha

Kulcha is a traditional Indian leavened flatbread made with yeast and yogurt co-culture. The use of refined flour in kulcha decreases its content of dietary fibre (DF)

and associated bioactive compounds. Multigrain blend of flatbread is a good source of protein, DF, minerals, and many other bioactive compounds. In the present work, efforts were made to develop fibre enriched functional Kulcha. Initially optimization of whole wheat kulcha ingredients such as, yeast, yogurt, oil, sugar, salt and water was carried on the basis of sensory overall acceptability score. The standardized kulcha was replaced with whole grain flours of buckwheat, barley and oat flour (5, 10, 15 and 20%). Chemical and technological analysis of flours was studied including bulk density, water absorption index and maltose figure. Kulchas can be prepared by incorporating buckwheat, barley and oat flour in whole wheat flour at level up to 20%, 15% and 10% respectively without affecting sensory attributes. The effect of above ingredient's incorporation on kulcha dough textural parameters like dough stickiness, dough strength and spread-ability was studied. Spread-ability of the dough was decreased and dough stickiness increased with the addition of above ingredients rich in dietary fibre. However, these ingredients can modify many properties of the dough and the flatbread, so the kulcha making process has been adjusted to achieve desirable products. Fermentation parameters like total acidity, pH and dough raising capacity were also studied. Physical test done to understand the changes in colour, thickness and texture.

Further, a model capable of predicting the product quality of multigrain Kulcha was developed using response surface methodology (RSM). Using a statistical software tool Mixture Design, the effect of various multigrain flours addition of Kulcha quality were evaluated. According to D-optimal approach, effect of these components (multigrain flours) on dough stickiness, total dietary fibre content and sensory acceptability of multigrain functional fermented Kulcha was evaluated and optimum combination was determined. Optimum combination obtained was studied for its nutritional content and staling studies were studied for a period of 5 days. Nutritional aspects: TDF in optimized kulcha was increased by 81.72% when compared with control. Due to the presence of phytic acids in wholegrain flours, IVPD of optimized kulcha was low (67.93) and that of the control was 70.17. Storage studies: 0.5% Guar gum was added to multigrain optimized kulcha. Staling in kulcha occurs both at room temperature and refrigerated temperature storage, Moisture content, WSS and IVED was reduced by 33.62%, 74.75% and 25.94% respectively on storage at 27 °C & 70% RH for 5 days whereas at 4 °C for 5 days it was reduced by 24.5 %, 55.07% and 18.86% respectively.

Research Student: Vaishali Mishra

Research Supervisor: U. S. Annapure

Development of a functional

food product using prosopioneraria

Barley and sorghum malt is to beer as grapes are to wine. Approximately 10% of the world barley crop after malting is used for the production of beer. Malt forms the base material for making wort, the liquid extract that is fermented into beer. Different malt types are used to generate different characteristics in beer products including flavour, colour and mouthfeel. Beer is the product of the alcoholic fermentation by yeast of extracts of malted barley and sorghum. The sugars that are converted to alcohol for the most part arise from endosperm which contains starch.

Cold plasma processing as a technique for enhancement of germination of grains, namely barley and sorghum was investigated. The grains were subjected to cold plasma or low-pressure plasma treatment at three different power levels (40W, 50W and 60W) and for different durations (10 min, 15 min and 20 min). Analysis of the grain germination characteristics showed that the cold plasma treatment has no such significant effect on the germination rate and mean daily germination for barley and sorghum. For speed of germination of barley there was no significant effect but for sorghum 22.99% increase was observed. The treatment had resulted in increased root lengths by 16.39% and 38.29% for barley and sorghum respectively.

After 72 h germination for barley and 96 h germination for

sorghum, the physicochemical properties of the treated and untreated grains were studied by characterization of malt. A significant increase was observed in the activities of the enzymes like amylase by 16.5% and protease by 11.24% in sorghum malt. Total sugar showed no significant difference and soluble protein contents showed increase of 6.28% in barley and 25.08% in sorghum.

The optimum power and time for beer fermentation of barley and sorghum by was 50 W, 10 min and 60 W, 15 min respectively. Yeast *Saccharomyces boulardii* inoculum was optimized to 2 %. Fermentation was done and pH, specific gravity, alcohol content and yield of the beer were calculated and it has been found that plasma treated samples gives better results than control. GC was done for the estimation of methanol in beer. On the basis of sensory evaluation plasma treated beer was liked more than the control in both barley and sorghum.

Research Student: Manjusha Joardar

Research Supervisor: S. S. Lele

Integration of biotechnology for the development of functional food product

India is the leading producers of mangoes in the world. However, only 0.2% of the productivity is exported, 0.8% is used for processing and rest 28.2% are lost at different stages of processing starting from farm to fork. Utilisation of these mangoes for the development of various functional food products like Nata de mango incorporated

beverage and carotenoid (Vitamin A) enriched oil (from left over) has been proposed in this study.

Nata de Mango is bacterial cellulose produced by the fermentation of mango pulp using *Acetobacter xylinum*. Its production was already optimised in a previous report of (Pal. H.,2016). To continue with the work this paper studied the kinetics of Nata de Mango production. During the Nata de Mango (NDM) production a first order reaction was followed between 0-44h of fermentation process. However after 44 h the rate of fermentation became independent of the sugar concentration and thus followed zero order kinetics. A highly inverse relation was observed between the sugar content and weight of NDM formed. By the 9th day of the fermentation process the sugar content of the liquid medium dropped from 10.52 ± 0.42 gm/100gm to 2.91 ± 0.45 gm/100gm giving a thick NDM sheet 29.67 ± 0.17 gm weight. The structure, chemistry and the textural property of NDM was studied compared with commercial NDC samples which revealed that NDM and NDC are basically composed of cellulose and water. In addition to this bond several other bonds were noticed in NDM after FTIR analysis which was because the substrate and difference in its method of its production. The textural property of NDM was also different from NDC. It was noticed that NDM was very hard and chewy in nature and hence was given a treatment with 0.1N NaOH for 15min followed by

soaking in 20% sugar syrup. This NDM pieces were further incorporated in beverage and compared with real fruit pieces which were of two types i) osmotically dehydrated fruit pieces and ii) dehydrated mango leather pieces. The TPA and sensory analysis revealed that fruit leather pieces were not at all accepted as they completely loosed their texture in beverages and also the same for osmotically dehydrated pieces. NDM on the other hand was as good as NDC in beverage.

The second part of the work focuses in the utilization of spent broth for recovery of value added food product. Due to the constraints over the use of organic solvents and increasing consumers demand for natural product, a green and an inexpensive technique was developed for direct extraction of carotenoid using common edible vegetable oils as solvent. The highest extraction yield ($0.232 \pm 0.02\text{mg/gm}$ of pellet) was obtained using sunflower oil at (1:40:: waste: oil ratio) for 90min. The yield was also increased by giving different pre-treatments and the best result ($0.416 \pm 0.02\text{gm/gm}$ of pellet) was obtained after drying followed by grinding. The pigment extracted in the not only enhanced the oxidative stability but also increased the functional value of the final product due to antioxidant property.

Research Student: Saaylee Danait

Research Supervisor: S.S. Arya
Studies on novel, functional,

probiotic yoghurt from peanut milk

Malnourishment is highly prevalent in India, especially among the children under 5 years of age. India is the second largest producer of peanut in the world. Along-with peanut being an inexpensive source of protein and fat, it is also touted as a functional food. Nowadays, awareness regarding the health benefits of probiotics is rapidly increasing and apart from milk, various food matrices are being explored as carriers of probiotics. Keeping these factors in purview, peanut milk prepared from whole skin peanuts was used for the study. The present study was designed to develop a fermented, probiotic, functional yoghurt from peanut milk.

Raw and roasted ($150^\circ\text{C}/10\text{ min}$) peanuts were utilized to prepare peanut milks by two methods: traditional method and modified method (pressure blanching). Processing treatments like roasting and pressure blanching increased the total phytochemical content and the total antioxidant activity of the peanut milk by approximately 60% and 34%, respectively. The total reducing sugar content of the peanut milk was 2.45 mg/ml and the total soluble protein content was 74.62 mg/ml . This bioactive enhanced peanut milk was fermented using the ABT-5 culture (consisting of *Lactobacillus acidophilus*, *Streptococcus thermophilus* and *Bifidobacterium lactis* for 8 h at 37°C . During and after fermentation, the microbiological, sensory and physico-chemical characteristics

of the peanut milk yoghurt were studied. The pH of the peanut milk yoghurt was 3.6, titratable acidity was 0.86 %LA and the total soluble solids was 14° Brix . During the 21-day storage at 4°C , the peanut milk yoghurt retained its structure and organoleptic properties and the viable counts of probiotics was within the recommended range of $6\text{-}7\text{ log}_{10}\text{ CFU/mL}$ based on a 100-mL daily dose.

Research Student: Pratiksha Avhad

Research Supervisor: U. S. Annapure

Isolation and production of melatonin from saccharomyces boulardii

Melatonin, chemically also called as N acetyl-5-methoxy tryptamine is a hormone that is produced by the pineal gland in animals and regulates sleep and wakefulness. This hormone can be used as a sleep aid and in treatment of sleep disorders like sleep latency, sleep quality, daytime alertness, sleep efficiency, Daytime alertness, Sleep onset latency, Delayed sleep phase disorder etc. Melatonin is an antioxidant and is the direct scavenger of free radicals which makes it also useful for the treatment of insomnia, headache, cancer, gallstones, and protection from radiation.

Saccharomyces boulardii is a yeast which is well known for its use as a probiotic property. This yeast is used in many countries as both preventive and therapeutic agent for diarrhea and other GI related disorders. Research on melatonin is focused

particularly on its production and isolation. One factor at a time was optimized on physico-chemical parameters such as the carbon and nitrogen sources, inoculum concentration, pH and temperature. The data generated was used in Response Surface Methodology (RSM) for medium optimization to increase the yield of the melatonin. RSM increase the yield of melatonin. Extracellular melatonin was in higher concentration as compared to intracellular. Cell lyses was successfully done by ultra-sonication probe and standardized at 10 minutes & 100 % duty cycle. *Saccharomyces boulardii* and *Saccharomyces cerevisiae* was compared for its melatonin activity which resulted in twice high yield of melatonin in *saccharomyces boulardii* as compared to *sacchromyces cerevisiae*. Melatonin is generally produced under stress conditions. Stress like ethanol, surfactants was studied. Increase in yield of melatonin was observed under stress.

After applying all optimizations, protein was precipitated by ammonium sulphate and purified by dialysis membrane which increased the yield of melatonin after dialysis. SDS page showed clear band of melatonin from the test sample which is in the range of standard melatonin band.

Research Student: Rutumbara Haripurkar

Research Supervisor: L. Ananthanarayan

Extraction of caratenoids from plant sources and its

applications

Growing demand for eco-friendly and non-toxic pigments has led to exploration of underutilized sources having considerable amounts of carotenoids. *D.regia*, *C. indica* and *Cucurbita* were selected as potential candidates for carotenoid extraction. Carotenoids are being currently extracted by conventional techniques, while exploration of alternative methods could lead to greener techniques which could increase the yield as well as decrease the time and cost. Hence, exploration of newer techniques for extraction of carotenoids from selected sources was undertaken. The objective of the present work was to obtain a good yield of carotenoids from selected sources, using EAE, UAE and MAE techniques. Various parameters such as concentration of enzymes and time of incubation were optimized in case of EAE. Using ultrasonication, effect of power, duty cycle, extraction time and solvent was optimized. MAE was optimized with respect to power, extraction time and solid to solvent ratio. The results indicated that when carotenoid pigment yield obtained using different methods were compared with the yield of pigment from respective sources, it was found that microwave assisted extraction method had maximum efficiency as well as required less time. But UAEE approach gave the best results amongst all. Vegetable oils were explored as novel solvents but overall yield of carotenoid

obtained was low.

Research Student: Priyanka Sawant

Research Supervisor: R. S. Singhal

Enzyme assisted aqueous extraction of flaxseed oil

Flaxseed is rich source of ω -3 fatty acid, α -linolenic acid (ALA). It also contains short chain polyunsaturated fatty acids (PUFA), soluble and insoluble fibers, phytoestrogenic lignans (secoisolariciresinol diglycoside-SDG), and proteins. Flaxseed is attributed with many health benefits such as decreased cardiovascular diseases, decreased risk of cancer, specifically of the mammary and prostate gland, anti-inflammatory activity, laxative effect, and alleviation of menopausal symptoms and osteoporosis, all of which are due to ALA. Conventionally, flaxseed oil is extracted using hexane as solvent. However, oil industry needs alternative method for extraction to replace hexane as this can lead to potential health risks and also issues regarding environment. In this regard, enzyme assisted extraction and greener methods are gaining much recognition. In oil industry, cost cutting, environmental and safety issues can be developed by enzyme-based processes. There is a need to develop optimized and comprehensive protocol for enzyme assisted aqueous extraction with increased oil recovery.

The emphasis of this study is to investigate the effect of different enzymes viz. viscozyme,

cellulase, hemicellulose, pectinase and protease, alone and in combinations for their effectiveness on the aqueous extraction of flaxseed oil and protein. Enzyme mixtures were found to be more effective than single enzyme. The yield of the oil was significantly ($P < 0.05$) higher (75.2%) with enzyme assisted method as compared to control (13%). Use of ultrasound treatment (40 W power for 15 min) after enzyme treatment increased the oil yield to 93.08 %. The physicochemical properties of flaxseed oils extracted by conventional solvent extraction, enzyme assisted aqueous extraction and ultrasound assisted aqueous enzymatic extraction (UA-AEE) were compared. Significant ($P < 0.05$) differences were observed iodine value, peroxide value, acid value and DPPH activity. The oil recovered from UA-AEE had lower peroxide and acid value when compared to oil extracted with organic solvent.

An appreciable amount of protein from seed was extracted into the aqueous and creamy phases during aqueous extraction of oil. Extraction and purification of vegetable proteins is mostly performed by alkaline extraction followed by an isoelectric precipitation. Several factors influencing the protein extraction process viz. pH, ionic strength, temperature and process time influence the protein yield and functionality. At alkaline pH the proteins exhibit a maximum solubility. Maximum protein was extracted at optimum conditions of 60°C

with a solid to water ratio of 1:10 at pH 10.

In addition to its nutritional characteristics, flaxseed protein provides prominent functional roles in foods. These functional characteristics include Solubility, rheological behaviour, emulsifying capacity, and foaming and whipping ability. The maximum foam stability (80 %) and emulsifying capacity (80 %) was observed at pH 6. Emulsion stability was achieved a maximum value at a pH of 8 (88 %) and a minimum at a pH of 4 (48 %).

Research Student: Sruthy Thanakudan

Research Supervisor: L. Ananthanarayan

Studies in the development of sourdough breads

Since the dawn of agriculture, bread has been consumed as a staple food and holds a cardinal position in the national and international food market. Sourdough breads are much healthier compared to normal bread however its conventional five day starter process makes it more tedious and cumbersome to follow. In the present work a comparative study was done on use of different starter cultures to make sourdough breads by a quick method. The starters used included baker's yeast, homemade dahi, commercial yoghurt and commercial yoghurt in combination with yeast culture. The homemade dahi culture and commercial yoghurt in combination with yeast culture provided a stable consortium of LAB and yeast strains with LAB: yeast ratio of

164:1 for homemade dahi and 106.25:1 ratio for commercial yoghurt in combination with yeast culture. Hence these starters were selected for further evaluation of sourdough bread. The sourdough bread made from commercial yoghurt in combination with yeast culture obtained a better sensory score of 7.38 ± 0.19 than homemade dahi with a sensory score of 6.56 ± 0.27 . This work has therefore helped to develop an easy one day process to make the sourdough bread of acceptable quality as compared to the conventional five day process. The process of sourdough fermentation was chosen to develop multigrain formulations of sourdough breads with indigenous Indian grains, to provide the consumers a ready-to-eat convenient food enriched with the goodness of traditional grains. However gluten dilution leads to poor bread structure. Hydrocolloids are most commonly used as binders in gluten free formulation. Ground basil seeds were investigated for their potential to mimic gluten in multigrain formulation. The optimized value for basil seed addition in multigrain formulation was found to be 2% w/w with stickiness value of 33.47 ± 0.62 and 17.5 ml water addition. Basil seed addition in multigrain sourdough decreased the bulk density and crumb firmness and delayed staling. An improved sensory score of 6.93 ± 0.21 was obtained for multigrain sourdough bread with 2% basil seeds and flavored with almond and milk. The effect of idli batter isolates on

sourdough fermentation was investigated. The pellet obtained after 48hrs of incubation of the isolates was sufficient enough to effectuate leavening in starter dough and decrease the conventional time of starter preparation to one day and produce sourdough bread of acceptable quality to consumers.

M.TECH. (BIOPROCESS TECHNOLOGY)

Research Student: Bhupendra Thakre

Research Supervisor: U. S. Annpure

Production of cellulose from saccharomyces broularaii using food industrial waste

Cellulase is the enzyme that catalyzes cellulolysis which makes it one of the industrially important enzymes. The present work explores the production of cellulase from *Saccharomyces boulardii* in a single step using a CMC as a substrate. The aim of this project is to study production, purification and characterization of cellulase from *Saccharomyces boulardii*. One factor at a time was studied to optimized physico-chemical parameters such as the carbon, nitrogen sources, inoculum concentration, pH and temperature. Optimization of various fermentation parameters affecting enzyme production by *Saccharomyces boulardii* was investigated by using Response Surface Methodology (RSM). Cellulase was then produced in the best suited media, isolated by centrifugation. Studies on cellulase activity in the presence of different metal ions and environmental factors were

investigated. Cellulase is then partially purified by using simple, rapid and cost effective aqueous two phase system composed of polyethylene glycol and salt which will separate cellulase from other impurities. Ultra filtration was performed using 30 KDa cut-off membrane by which smaller molecules were eliminated. The final activity of cellulase was increased upto 310% as compared to the crude cellulase (before RSM). *Saccharomyces boulardii* showed better results as compared to *Saccharomyces cerevisiae*.

Research Student: Gyanendrakumar Gautam Research Supervisor: S.S.Arya Extraction of carotenoids from micro algae with the help of cloud point extraction method.

This study was investigated the use of micelle – mediated extraction of lipid from micro algae and cloud point pre-concentration of the extract. The non - ionic surfactant triton x-114 was chosen as extraction solvent. Various experimental conditions were investigated to evaluate and optimize the extraction process. The highest yield was obtained with 8% (v/v) aqueous triton x- 114 solution. .75 gram algae dried biomass was taken in 100 ml triton x-114 solution and bath sonicated for 40 min. In addition, the cloud point pre-concentration was optimized under the condition of 25 % (w/v) sodium chloride and equilibration at 80 °c for 10 min. The extract obtained was analyzed by gs-ms. Finally, the

method was successfully applied to separate and determination lipids in dried microalgae biomass. These results obtained were compared with modified bligh and dyer method and soxhlet extraction method. The results indicated that all the extraction yield of lipid obtained by micelle extraction was higher than those two-other methods. Moreover, the proposed technique consumed less toxic organic solvent compared with traditional method.

Research Student: Rathi Sushil shrinivas Research Supervisor: J.S. Gokhale

Computational studies of anaerobic digester and process optimization

Anaerobic digestion is a well versed process and can find its application in degrading waste and converting it to biogas. Despite being an effective process for treating waste, it is not implemented due to some drawbacks such as its slow rate of reaction, requirement of large amount of water to treat the waste and requires high hrt and srt due to slow rate. If anaerobic digestion is carried out at higher solid loading, with total solid loading in the range of 30% to 35% it will help in increasing overall biogas yield for the same capacity of digester. Also it will help save water as a utility and will reduce the problem of leachate handling. When an anaerobic digestion is carried out at higher solids it is called high solid anaerobic digestion (hsad). When an hsad system is operated it is important to have

proper mixing as dead zones present in the system will reduce the efficiency and stratification occurring in a large scale hasd will increase the chances of inhibition. A need to develop an effective and lower power consumption mixing system is the chief objective. Mechanical mixing and pneumatic mixing are used in ad but power consumption is high and efficiency is low. Hydraulic mixing can be an effective method for mixing in ad without any extra power requirement as it will only require the pump power to inject the slurry inside the digester. Using different type of distributors to use the kinetic

energy and pressure energy of the feed slurry to suspend the particles in the digester. Flow pattern and velocity regime of various designs were studied using computational fluid dynamics (cfd) and experimental fluid dynamics (efd) to establish appropriate and efficient mixing system. Upv was used for experimental studies.

SEMINAR/CONFERENCE/ WORKSHOP ATTENDED BY RESEARCH STUDENTS

**Summer Trainees sponsored
by IAS-NASI-INSA under
Summer Research Fellowship**

Programme 2017

- Somi Srivastava: She worked on determination of the heat abuse of oil present in legume based fried foods
- Anusha Unni: She worked on estimation of polar compounds in cereal based fried items

ACADEMIC PERFORMANCE AWARDS

- The Association of Food Scientist and Technologist (I) Mumbai Chapter Award to Mr. Somnath Basak for first rank in S.Y.B. Tech. (Foods), Sem-IV, 2017

COCURRICULAR AND EXTRACURRICULAR AWARDS

Sr. No.	Name of Student	Class	Event	Activity	Prize
1.	Ketan Mulchandani	Ph.D	SPORTSAGA 2K18	Cricket	Runner-up
2.	Ketan Mulchandani	Ph.D	YUVAM 2K18	Cricket	Winners
	Abhijeet B. Muley				
3	Kapil Rai	M. Tech	YUVAM 2K18	Table Tennis	Runner-up
4	Abhijeet B. Muley	Ph.D	FUNTECH	Badminton	Runner-up
5	Abhijeet B. Muley	Ph.D	YUVAM 2K18	Tug of War	Winners
	Sachin R. Adsare				
6	Shubham Gaikwad	M. Tech	YUVAM 2K18	Chess	Winners
7	*Sneha Awasthi (Captain, Team ICT)	M.Tech	SPORTSAGA 2K18	Cricket	Winners
	Kakoli Pegu (Vice-Captain, Team ICT)				
	*Anusha Mishra	Ph.D			
	*Aditi Rungta				
	*Sneha Kamble				
	*Stuti Agrawal				
8	*Sneha Awasthi (Captain, Team Hostel-2)	M.Tech	YUVAM 2K18	Cricket	Winners
	*Kakoli Pegu (Vice-Captain, Captain, Team Hostel-2)				
	*Sneha Kamble				

9	*Aditi Rungta (Captain, Captain, Team Hostel-3)	M.Tech	YUVAM 2K18	Cricket	Runner-up
	*Anusha Mishra (Vice-Captain, Captain, Team Hostel-3)				
	*Stuti Agrawal	Ph.D			
10	*Krutika Bhangale	M. Tech	YUVAM 2K18	Fashion Show	Runner-up
	*Harshal				

(* Indicates woman student)

BATCH OF 2018

- B. Tech. Merit Prizes (ICT Students' Fund), Mr. Pranav Kiritkumar Raval

BATCH OF 2019

- Professor P.J. Dubash Memorial – AFST (I) Mumbai Chapter Award to the B. Tech. Food Engineering and Technology Department for securing Highest marks in the subject of Food Chemistry (Theory), Mr. Somnath Bask
- B. Tech. Merit Prizes (ICT Students' Fund), Mr. Somnath Basak (S.Y.B.Tech-Food)

BATCH OF 2020

- B. Tech. Merit Prizes (ICT Students' Fund), Mr. Yash Shah (F.Y.B.Tech.-Food)

PLACEMENTS

The FETD actively attempts to place the graduates in various national and multinational industries in the field of food and biotechnology. Various companies visit the campus to select best of the students.

PLACEMENT OF B.TECH. (FOOD ENGINEERING & TECHNOLOGY)

Year	Graduates Employed		Higher Studies	
	Passed	Industry	India	Abroad
2014	18	12	2	3
2015	16	4	1	6
2016	16	4	3	6
2017	16	7	01	04
2018	14	6	01	02

PLACEMENT OF M. TECH. (FOOD ENGINEERING & TECHNOLOGY)/M.TECH (FOOD BIOTECHNOLOGY)

Year	Masters Employed		Higher Studies	
	Passed	Industry	India	Abroad
2014	21	08	-	01
2015	21	06	-	-
2016	22	14	-	-
2017	22	11	-	-
2018	22	07	1	-

PLACEMENT OF PH.D. (TECHNOLOGY / SCIENCE)

Year	Doctorates Employed		Higher Studies	
	Passed	Industry	Academics	Abroad
2014	9	4	2	-
2015	8	4	3	1
2016	12	5	3	-
2017	3	-	-	-
2018	9	-	-	-

CAMPUS PLACEMENTS 2016-17

Sr.	Company	Student	Degree
1.	Weikfield Foods Pvt. Ltd.	Deepanshu Garg	M.Tech.
2.	Pepsico India	Mahesh Dudhal	B.Tech
3.	Halftick info services	Prathmesh	B.Tech
4.	VKL Pvt. Ltd.	Batul Hussain	B.Tech
5.		Bulbul Vij	M.Tech.
6.		Aroshi Sharma	
7.		Vrushti Shah	
8.		Cheryl Fernanded	
9.	ITC	Vardan Singh	M.Tech.
10.	Agilent Technologies	Medha Narag	B.Tech
11.		Shruty Joy	M.Tech.
12.	Tastybite	Niharika Soni	M.Tech.
13.	Capital Foods	Rutumbara Haripurkar	M.Tech.
14.		Swarnali Das	
15.	Cavin care	Manjusha Joardar	M.Tech.
16.	A & B chemicalCorp.	Ameya Pathak	B.Tech
17.	Marico Industries	Rushabh Govardipe	B.Tech
18.	P. D. Navkar	Darshan Wavare	B.Tech

CAMPUS PLACEMENTS 2017-18

Sr.	Company	Student	Degree
1.	Danone , Punjab	Pranav Raval	B.Tech
2.		Rohit Jorigal	
3.	Pepsico	Noopur Mehta	B.Tech
4.	Mondelez indra foods pvt. Ltd. Thane	Alisha Sukhija	M.Tech.
5.	Evalueserve, Gurgaon	Prabhat Chauhan	M.Tech.
6.		Kapil Rai	
7.		Yash Kakani	B.Tech
8.	Godrej, Vikhroli	Shubham Purandare	B.Tech
9.	Marico	Vaishnvi Patki	B.Tech
10.	ITC	Sneha Awasti	M.Tech.
11.		Harshal	
12.	Spinco Biotech Pvt Ltd, Navi Mumbai	Nitin sangle	M.Tech.

SUMMER PLACEMENT

Sr.	Student	Class	Place/Project	Period (May 15, 2018 to June 30, 2018)
1.	Jaishree Kumbhare	S.Y.B.Tech.	Blending of debittered bittergourd juice with different fruit and vegetable juices	45 days
2.	Rahul Venkatram	S.Y.B.Tech.	Effect of cold plasma on sago	45 days
3.	Yash Shah	S.Y.B.Tech.	Effect of cold plasma on sago	45 days
4.	Sourabh Joshi	S.Y.B.Tech.	Sprey drying and freez drying of Kokum fruit	45 days
5.	Vimi Kuwlekar	S.Y.B.Tech.	Sangri seed flour cookies	45 days
6.	Akshay Koradia	S.Y.B.Tech.	Probiotic and prebiotics	45 days

CO-CURRICULAR EVENTS AND PERSONNEL TRAINING

PERSONNEL TRAINED

Students from various institutes visited the FET Department. A Departmental tour to various labs was organized by our faculty. Food processing equipments and other facilities were shown to them. The details of the institutes and number of students who visited the Department are given below.

Sr. No.	Name of the institute	Date of Visit	Background of the students	No. of students
1.	Ruia College, Matunga	16/12/2018	3rd year Post Harwasting technology	13
2.	Departmental Visit from Tamil Nadu Agricultural University	12/03/2018	Finar year Food Technology	50

MOU BETWEEN ICT AND MALAYSIAN PALM OIL BOARD

After a successful seminar on palm oil and its application, value addition to palm products, nutritional and health attributes of palm oil, a memorandum of understanding (MOU) was signed between Institute of Chemical Technology and Malaysian Palm Oil Board on Collaboration in technology development in the field of palm oil on 3rd April, 2017. Both sides will take necessary steps to encourage and promote co-operation in the development and promotion of palm based foods and non-food products in india.

RENEWING – ALWAYS A POSITIVE CHANGE

The cabin of the Head of the Food Engineering and Technology Department was renovated and the newly renovated HOD cabin was inaugurated at the hands of padmashree Prof. G.D. Yadav on 7th April, 2017.



BAKERY TECHNOLOGY WORKSHOP

A 3 day “Bakery Technology Workshop” was held at FETD from 27th to 29th July, 2017. It was jointly organized by FETD and Assocom Institute of Bakery Technology and Management (AIBTM). There was a session on introduction to bakery products, bakery equipments and short bread cookies. The participants learnt about the different ingredients and mixing methods involved in preparation of breads, cookies and cakes. They prepared chocolate chip cookies, buns, chiffon cake, chocolate truffle cake, French baguette and hard oils.



DASSARA PUJA 2017

We celebrated ‘Dassara’ in our department with grandeur and pomp. Colourful rangolis made by all the lab members adorned the labs. Like every year, the dasara pooja was performed in the processing lab of Food Engineering and Technology Department to seek the blessings of the deity. All the students were dressed in traditional attires representing the colourful and unique culture of India. The function began at 11.20 am on September 29, 2017 with an aarti and floral offerings to goddess Saraswati. Professor G. D. Yadav, Vice Chancellor, ICT paid their visit to the function. All the faculty members, non teaching staff and students of FETD got together for the puja, aarti. The auspicious occasion concluded with hearts filled with happiness and peace.



NATIONAL NUTRITION WEEK 2017: THE HOW, WHEN AND WHAT OF

ICT Nutrition week was held on 17th sep, 2017, Thursday, in association with AFSTI (Mumbai Chapter) and MPOB, Malaysia. The theme for the Nutrition Week was “Put your best fork forward”. The competitions held at the event saw the participation of large number of students both from ICT and other colleges. The competitions were followed by talk from some distinguished guests and faculty namely, Prof. Uday Annapure (Head FETD, ICT), Mr. Nilesh Lele (Secretary, AFSTI Mumbai Chapter), Dr. Nagendran (Guest of Honour, MPOB, Malaysia) and Dr. P. Muthumaran (Chief Guest, Director, FSSAI). Dr. Shalini Arya Concluded the session with vote of thanks. There was a debate competition where participants debated over two topics:”Modern food eating habits v/s traditional food eating habits” and “food product advertisement: Are they fooling the consumers”. There was a poster competition in which young creative minds expressed their thoughts about “ Healthy whole grains”. There was also a recipe contest based on the theme “salt free or low sodium recipe”, in which cookies won the first prize.



THANK YOU FOR CONSTANLY FEEDING OUR THOUGHTS-TEACHER'S DAY AT FETD

Teacher's Day has always been special at FETD, but this year it was particularly noteworthy because it was celebrated by the M.Tech and Ph.D scholars in unison. They took this opportunity to felicitate all their professors and seek their blessings.



PLATINUM JUBILEE CELEBRATION OF THE FETD DEPARTMENT & ORGANISATION OF ALUMNI MEET 2018

The Alumni meet was organized on 6th January 2018 on the occasion of Platinum Jubilee celebration of the Food Engineering and Technology Department. Around 120 Alumni from different parts of the country gathered to refresh their college memories. The Alumni were well distinguished in their job and some were also successful entrepreneurs. The meet proved a great

platform to collect funds for the development and upgradation of foods department.

Yogesh agarwal , a dynamic alumni took an initiative to bring all the fetd alumni in a whatsapp group and then shifted to telegram group as the participants kept on increasing. at the same time, the department celebrated its 75th anniversary.

Professor Uday S. Annapure invited the gathering. Major

achievements and developments of the department were highlighted. He also shared Information regarding various modifications made in the course curriculum that enable students to gain industrial knowledge during their academic period. Industrial internship is now a part of curriculum for the MTech students.

He also highlighted alumni who have donated funds for

the renovation of the foods department laboratories such as Mr. Lalit Chadha (BSc Tech Foods, 1965), MD of Goodwill Group of companies, donated funds for the renovation of PTC Lab. Similarly Dr. Anil Shrikhande (BSc Tech. Foods, 1965) donated funds for the renovation of processing lab. Most of the labs are yet to be renovated for which funds are required

The alumni meet and platinum jubilee celebration of our department was graced by our hon'ble vice chancellor prof. dr. g.d yadav. he recollected old and golden memories with the department from the days of his joining ict as a student

DEPARTMENT VISITS

Delegates from Industrial Technology Institute, Sri Lanka had visited the food department, ICT as the joint Indo-Srilankan project on cold plasma treatment on various spices are being studied here. They visited various industries like Ravi Masale Pvt. Ltd Aurangabad and Swani Spice Mill Pvt Ltd., Mumbai.

Presentation was given by dr. p neville r j amunugoda ,research scientist ,fruit and vegetable laboratory .he highlighted major research areas focussed in his college and focussed on the need for indo sri lankan collaboration for further progress in the research area.he highlighted major projects undertaken under him like development of dual energy continuous dryer for commercial use, establishment of dual energy dryer at selected vidhatha centers in sri lanka,

development of rack dryer for black lime production, effective utilization of ginger (postharvest management and processing), extending storage life and improving quality of pineapples for export market. the major interest areas included minimizing post harvest loss of fresh produce including methods of design developments of machineries and innovations preservation methods , herbal drinks product development, kilns and burners development, project feasibility studies and marketing ,integrated farming systems combine with food.

WORKSHOP ON FOOD PRESERVATION TECHNIQUES

Workshop on food preservation techniques was jointly organized in association with biotechnology industry research assistance council (BIRAC) and Department of food engineering and technology, ict, mumbai on and from 26thfebruary -28th february.

ACHIVEMENTS OF OUR STUDENTS - DuPont Nutri Scholars Awards 2017

- Ms. Aratrika Ray , Mrs. Suman Kumari and Mrs. Anu Ahlwawat stood second and won One lakh cash prize in the category **ULTIMATE HEALTH AND WELLNESS PRODUCT** under the guidance of **Dr. US Annapure**
- Ms. Madhura Janve, Mr. Baburaj Regubalan , Ms. Shraddha Srinivasan and Ms. Sona Shaikh won Stood second and won cash prize of one lakh in the category

MOST NUTRITIOUS FOOD IDEA under the guidance of **Dr. Lakshmi Ananthanarayan**

DEPARTMENTAL VISIT FROM TAMIL NADU AGRICULTURAL UNIVERSITY

An educational trip was organized and conducted by tnau in our department. they were introduced to instruments of our departmental labs. it was a nice collaboration between ict and tnau. it was organized on 12th March, 2018.

ACHIEVEMENTS IN THE FIELD OF SPORTS

First time in the history of ICT, a girls' cricket team has been formed and participated in Sport Saga, an inter-college sports event, held every year by ICT. This year department students namely **Ms. Anusha Mishra, Ms Kakoli Pegu, Ms Stuti Aggarwal, Ms Aditi Rungta, Ms. Sneha Awasthi and Ms. Sneha Kamble** from the Department of Food Engineering and Technology was part of the winning team of Girls' Cricket which was successfully coached by **Mr. Abhijeet Mulley**, student of our department as well. The girls have made not only the department but the whole Institute proud as well. Here is a glimpse of the event.

ACKNOWLEDGEMENT

We thankfully acknowledge the following Industries and Institutes for accommodating our Food Engineering and Technology students for summer training.

IN-PLANT TRAINING:

T. Y .B. TECH (FOOD ENGG. & TECH.) MAY-AUGUST 2018

Sr.	Name	Project Name	Company For IPT	Place
1.	Joseph Roshan	New product development of vegan protein bar	Eighty-20 foods	Dadar, Mumbai
2.	Chaitanya Phadke	Market analysis for rice fortification	Dsm food	Mumbai
3.	Dhelriya Ankit	New product development of protein bars	wholesom food	Mumbai
4.	Shreya Motwani	Value addition to de-oiled cake of coconut	Marico industries	Andheri, Mumbai
5.	Claudia Samuel	Expressed cheese based ingredients, specifically cheese and cheese analogues to develop at least one cheese appetizers prototype	Mccain	Delhi
6.	Krupa Dhurve	Product development-synthetic syrups	Frolic food	Mumbai
7.	Gore Nikhilesh	Supplier data management	Mccain	Gujrat
8.	Tupe Vismay	Reduction in water usage on the available process lines	Mccain	Gujrat
9.	Kharbanda Manjot singh	New product development of vegan protein powder	Eighty-20 foods	Dadar, Mumbai
10.	Somnath Basak	New product development of RTE products, premixes and process optimisation with wastage analysis on the production line	General mills	Mumbai
11.	Badiger shivani	New product development:Nut based biscuit cream filing	General mills	Mumbai
12.	Suryawanshi Sandeep	Study of Process Optimization, Oil Efficiency, Drip loss consequences and packaging	Vista food	Taloja, new mumbai
13.	Suryawanshi Tejas	Study of process optimization and Cook-In-Bag Process	Vista food	Taloja, new mumbai
14.	Wadhe Ankita	New product development of pearl millet bars and finger millet bars	wholesom food	Mumbai
15.	Erande Onkar	Analysis of packaging defects and there remedies on the available lines	Mccain	Gujrat

IN-PLANT TRAINING: M. TECH (FOOD ENGG. & TECH.) MAY- AUGUST 2018

Sr.	Student Name	Course	Industry	Project Name
1.	Aditi Runga	FET	Sensient India, Mumbai	Salt & sugar reduction in foods
2.	Admajith Kaimal	FET	Omni Active, Pune	Development of Carotenoid-Phytosterol oil suspension: Identification and optimization of quality attributes
3.	Madan Dhulgande	FET	Tasty bite, Pune	Evaluatve solid variation in top-3 SKU reduce manpower from rotarybilling machine
4.	Megha Dhingra	FET	Marico, Mumbai	1) To write a white paper on blended edible vegetable oils 2) To formulate a value addition product from deoiled coconut cake
5.	Naveen Kumar Shakya	FET	Mapro, Mahabaleshwar	Inhibition of staling in chapatti
6.	Oildrila Ghosh	FET	Tetrapak, pune	Analysis of food product trials at tetra pak India
7.	Prateek Katariya	FET	Tasty bite, Pune	Line balancing of NSL1 and find the bottleneck of top 20% products and reduce them without major capex
8.	Sagar Mahale	FET	Chitalebandhu mithaiwale, pune	Gluten free bakarwadi low glycemic sweets
9.	Sujay Ayachit	FET	VKL, Mumbai	To increase the productivity of flavor manufacturing operations
10.	Omkar Sawant	FET	Chitalebandhu mithaiwale, pune	Development of gluten free bakarwadi
11.	Dipak Gujar	FET	Sahyadri educational society,Chiplun	Fruit wine and research training
12.	Abdur Rehman Moh. Kalim Khan	FBT	Himedia, Mumbai	Techniques of animal cell culture & developing of a kit for detection of osteogenic differentiation
13.	Bisal prasher	FBT	Mondelez, Mumbai	Improvement of thermal stability of standard cream
14.	Deep kamal Dave	FBT	VKL, Mumbai	Lead time study of flavor manufacturing operations
15.	G V Lathika	FBT	AAK Kamani, Mumbai	Effect of natural anti-oxidants on frying
16.	Shreyasi phatak	FBT	Inovantus Technologies, Mumbai	Development of high fat/keto bar
17.	Shriya Das	FBT	Inovantus Technologies, Mumbai	Development of high protein bar

18	Sneha Kamble	FBT	Diageo, Bangalore	Foam retention in ready-to-drink low alcoholic beverage
19	Stuti Agarwal	FBT	Diageo, Bangalore	Pasteurization of RTD low alcoholic beverage
20	Sudharshini B	FBT	Diageo, Bangalore	Mouthfeel improvement of a low alcoholic RTD beverage

DONATIONS

Sr.	Person/Company	Amount (Rs.)
1	Aspartika Biotech Pvt.Ltd.	59000/-
2	Tansukh Jain	5000/-
3	Sudhir Dattraya Mestri	99000/-
4	SBH foods pvt. Ltd.	10000/-
5	Morde Food pvt ltd.	11000/-
6	Phalgun Trivedi	25000/-
7	Ramesh Ramakrishnan	5000/-
8	Unibourne food ingredients	30000/-
9	Val organics pvt ltd.	400000/-
10	Summar Internship Programme-2016/C.E	30000/-

MAJOR GRANTS RECEIVED IN THE LAST FIVE YEARS

Sr.	Sponsoring Agency	Amount / Year	Title
1.	DST-SERB	Rs.48 lakhs April 2017-March 2020	Pulse light processing of beverage using under-utilized fruits: value addition, process optimization & shelf life extension
2.	Rajiv Gandhi Science and Technology Commission (RGC)	Rs.67.27 lakhs 2014-2017	Exotic tropical fruit wines-microbrewery demo plant
3.	DST Govt. of India	Rs.130 lakhs 2013-2016	Holistic approach for commercial processing of fruits and vegetables grown in western Maharashtra
4.	DST-MOFPI, Govt. of India	Rs.22 lakhs 2013-2014	Studies in Physico-Chemical Properties of Plasma Processed Rice Grains
5.	UGC	Rs. 7 lakhs 2012	Augmenting of research facilities to further facilities in research work under the scheme of UGC-BSR One time grant
6.	UGC	Rs.100 lakhs 2008-2013	UGC CAS Phase – I
7.	Rajiv Gandhi Science and Technology Commission (RGC)	Rs. 189 lakhs 2007-2012	Preservation and processing of fruits and vegetables using sustainable technologies

RESEARCH GROUP

Ph.D. STUDENTS OF FOOD ENGINEERING & TECHNOLOGY

(Ph.D. TECH)

M.TECH STUDENT

Professor R. S. Singhal Research Group



Professor S. S. Lele Research Group



Dr. Uday S. Annapure Research Group



Dr. Laxmi Ananthanarayan Research Group



Dr. S. S. Arya Research Group



Dr. Jyoti Gokhale Research Group



Dr. S. Chakraborty Research Group

