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 witnessed a good time in academics, research as well as good campus placement encompassing national and multinational companies. It is a matter of great satisfaction and pride to all faculty members in the department imparted training to the students at all levels which made them able to meet the industry requirement in the emerging areas of food science and technology. The interdisciplinary masters program in food biotechnology has been now well established. WE are now getting very good response to recently started Ph.D. program in food science to attract students from diverse backgrounds and explore newer areas of research. During the year, we have had 55 publications in national and international journals and/or books. Currently there are 64 Ph.D. fellows and 47 M.Tech students working in the Department.

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.

We are thankful to UGC for the Center of Advanced Studies Status (CAS-I) and continued support by way of Ph.D. fellowships under the SAP program. Support from TEQIP too facilitated many students and faculty in attending conferences and showcasing their work. ICT has been active in instituting several merit-cum-means scholarship for the needy and meritorious undergraduate students. FETD has Dr. P.J. Dubash- AFST scholarship of Rs 25,000/- per year. In addition we are also thankful to PFNDAI and Kamani Oil Industries who have generously sponsored scholarshipsregularly. We are grateful to industry houses for accommodating our students for the mandatory 6-week in-plant training, to all the visiting faculties who have assisted us in

conducting our coursesdespite severe time constraints, and to all the examiners who have spared valuable time in evaluating theses of our M.Tech and doctoral students.

Department of Food Engineering and Technology also takes pride in playing leading role in co-curricular as well extension activities at ICT and also through professional body, Association of Food Scientists and Technologists (India) or AFST (I). The International collaborations in teaching as well as research continue in the FETD. We are indeed blessed to receive support from our well wishers, alumni and friends of the department. We also had thought provoking lectures by faculty from other universities as well as industry personnel under endowment lectures and under TEQIP.

This year there is a long list of achievemnts by our faculty and students. To highlight few, Prof. Lele received the "Unch Maaza Zoka" Zee Marathi National Award and Woman Achiever Award given by AkhilBharatiya Chitpawan Mahasangha.Also received the first prize for best paper and best invited paperawards-oral papers respectively at international conference on biotechnology for better tomorrow at Tampa USA.Dr. S.S. Arya was awarded as Young Scientist by AFST (I), Mysore.Prof. U.S. Annapure received the Best Teacher Award (Prof.D.V. Rege-AFST Mumbai Chapter-2011 Endowment).

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).

PROGRAMS OFFERED

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
4	Ph.D. (Tech.) (Food Engineering and Technology Ph.D. (Tech) (Food Biotechnology) Ph.D. (Tech) (Bioprocess Technology) Ph.D. (Biotechnology) Ph.D. (Biochemistry) Ph.D. (Food Science)	As per availability of seats	

* At Institute level

CURRENT STUDENTS :

Course	No. of Students	
	2015-16	2016-17
Masters (both years)	46[including 5 M.Tech (BPT)]	47[including 7 M.Tech (BPT)]
Ph.D. (Tech) (all)	37	35
Ph.D. (Sci) (all)	29	29
PGDCTM (all)	1	-
Post doc,	3	4

DEGREES AWARDED DURING 2015-16 & 2016-17

Name of Degree	No. of Students	
	2015-16	2016-17
B.Tech	17	16
M.Tech. (FET & FBT)	22[including 1 M.Tech (BPT)]	22[including 3 M.Tech (BPT)]
Ph.D. (Tech)	8	3
Ph.D. (Sci)	4	-

RESEARCH OUTPUT

		2015-16	2016-17
No. of Research Project	Govt.	3	3
	Private	4	4
No. of consultation Assignments		4	4
No. of Patents	Applied	-	-
	Obtained	-	-
No of Paper Published	National	-	-

	International	55 + 3 Book Chapters+2 Review Paper	55+ 5 Book Chapters
No. of Conference Presentations	National	7	10
	International	2	4
Citations*		>2515	>2830

*from the google scholar for the calender year 2017

PROFESSOR R. S. SINGHAL

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

- Fellow, Maharshtra 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.

RESEARCH STUDENTS

Ph.D. (completed) –29
Ph.D. (ongoing) – 17
Masters (completed) – 93
Masters (ongoing) – 7
Post-docs (completed) – 1
Post-docs (ongoing) – 4

PUBLICATIONS

International- 303
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: 51*

citations: 12195
*As per google scholar on June, 2017

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, neutraceuticals 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), neutraceuticals (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 □-carotene and lycopene by Blakeslea trispora 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, Maharshtra Academy of Sciences

Fellow, Biotech Research Society of India (BRSI)

Registrar & Professor of Biochemical Engineering

SUBJECTS TAUGHT

Introduction to food systems, Food Engineering, 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) – 26

Masters (completed) – 65

Ph.D. (ongoing) – 8

Masters (ongoing) – 6

RESEARCH PUBLICATIONS

International- 103

National- 8

Conference Proceedings– 25

Book / chapters– 5 chapters

PATENTS

02 (granted), 02 (applied)

SPONSORED PROJECTS

Government – 9(completed)
2(Ongoing)

AWARDS/HONOURS:

National – 12
International – 1

H-INDEX: 24*

citations: 2683
*As per google scholar on June, 2017

PROFESSIONAL ACTIVITIES

- Member, Board of Governor, BRSI 2015-2017.
- Member, DBT Star college review committee (2014-2016).
- 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, SomaiyaVidyavihar, Mumbai.
- Member, Scientific panel on contaminants in food chain of the Food Authority; FSSAI, New Delhi (2013-2016).
- Member, selection committee, DBT-Biotech Industrial Training Programme (BITP) 2015-16
- Member, Technical Advisory Board, NAFARI, Pune, (2015-18)
- Member, Technology Transfer Cell, RGSTC-MCCAI, Pune (2015-2018)
- 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, IIChE, UAA.
- Chair person, syllabus committee M Tech food biotechnology, BCIL, DBT New Delhi.
- Member, research recognition committee food science SNDT Mumbai.

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT

Prof. Smita 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 endeavours. 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, Prof. Lele has conducted about 10 hands on trainings on the various technologies where approximate 650 persons are trained on food processing (dehydration, retort processing, fruit wine making etc.)
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. To site one example – a woman was paid only Rs. 25 as the daily wage in the fields of soy and the job was only for 4 months whereas now she gets up to Rs. 200 per day and at least 100 women are employed in the plant and in fields. The indirect employment generated is about 1000 with one plant at Ambawade Gaon near Sajjan-gad, Satara. Similar kind of job generation is expected in Dahiwali, Sawarde, Chiplun where non-grape fruit wine and other nutraceutical product demo plant is set up recently.
Last but not least, the "Wholistic" approach of complete utilization of fruit / vegetable has resulted into sustainability and commercial viability of these projects. E.g. After getting Jamun juice for making beverages or wine, the pomace and seeds are dehydrated and converted as a Dry Product to be sold as medicine / nutraceutical for Diabetic population.
Her recent project of making

Biscuits from rice bran (which is completely wasted in Konkan area due to insufficient quantity at one location that could be used for recovering rice bran oil) is another innovative way to "Wholistic" approach and generating jobs for the rice grower farmers who have no jobs for 8 months. With implementation of this novel idea – wasted food grade rice barn is converted as food, farmers have jobs all 12 months, consumer will have affordable novel food and society in general will benefit.

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 □-galactosidase produced by an indigenousLactobacillus acidophilus isolate	Separation and Purification Technology	(2013). 110 (2013). 44–50	3.525
5	Synthetic dye decolorization by white rot fungus, Ganoderma sp.	Bioresource Technology	(2007) 98 (4): 775-780.	5.172
6	Kinetic and equilibrium modeling of chromium (VI) biosorption on fresh and spent Spirulina platensis/ Chlorellavulgaris 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 Procesing, 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

Downstream processing-enzymes, antioxidants, and biomolecules

RESEARCH STUDENTS

Ph.D. (completed). – 8
Masters (completed) – 53
Ph.D. (ongoing) – 17
Masters (ongoing) – 9

RESEARCH PUBLICATIONS

International- 61
International (this year)-14
National- 9
Conference Proceedings – 67
Patents- 2
Book Chapter – 1

SPONSORED PROJECTS

Government – 02 (completed)
Private – 2 (completed)
Private – 1(ongoing)

AWARDS/HONOURS

National - 01

H-INDEX: 17

citations: 866
*As per google scholar on June, 2017

PROFESSIONAL ACTIVITIES

- Vice President of AFST (I), Mumbai Chapter for 2015-16 and 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, 2016-17.
- Member, Selection committee for appointments of Assistant Professor at Shivaji University Kolhapur.
- 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, Test method for food products sectional committee (FAD 28) at BUREAU of Indian standard New Delhi.
- 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.
- Recipient of Prof. D.V. RegeBest Teacher Award from AFST (I), Mumbai Chapter 2016.

HIGHLIGHTS OF RESEARCH WORK DONE AND IT'S 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 sncak 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, rhelological properties and food applications.

TEN BEST REPRESENTATIVE PUBLICATIONS/PATENTS

Sr. No.	Title	Journal	Year, Vol.: Page no.	Journal impact factor (5 year)
1	Influence of cold plasma on fungal growth and aflatoxins production on groundnuts	Food Control	2017,77, 187-191	3.67
2	Comparative study of Acacia nilotica exudate gum and acacia gum	International Journal of Biological Macromolecules	2017,102, 266-271	3.92
3	Functional and rheological properties of cold plasma treated rice starch	Carbohydrate Polymers	2017,157,1723-1731	5.11
4	Cyclosporin A — A review on fermentative production, downstream processing and pharmacological applications	Biotechnology Advances	2011, 29 418–435	11.85
5	Acrylamide content in fried chips prepared from irradiated and non-irradiated stored potatoes	Food Chemistry	2011, 127 (4), 1668-1672	4.92
6	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	4.92
7	Effect of an alkaline salt (papadkhar) and its substitute (2:1 sodium carbonate:sodium bicarbonate) on acrylamide formation in papads	Food Chemistry	2009, 113(4), 1165–1168	4.92
8	Response surface methodology in media optimization for production of □-carotene fromDaucuscarota.	Plant Cell, Tissue and Organ Culture	2008, 93:123-132	3.66

9	Starch-based spherical aggregates: screening of small granule sized starches for entrapment of model flavouring compound, vanillin.	Carbohydrate Polymers	2003, 53, 45-51	5.15
10	Screening of hydrocolloids for reduction in oil content of a model deep-fat fried product.	Fett/Lipids	1998, 6(101), 217-221	2.26

DR. LAXMI ANANTHANARAYAN

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

Associate Professor, Coordinator M Tech (Food Biotechnology)

SUBJECTS TAUGHT

Chemistry of food constituents, Nutrition, Technology of plantation products, Food packaging, Current topics in food science and technology, Principles of Food preservation, Food Biotech 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) – 16
Masters (completed) – 73
Ph.D. (Completed) – 2
Masters (ongoing) – 7

RESEARCH PUBLICATIONS

International- 44
International (this year)-10
National – 02
Peer-reviewed-33
Book / chapters- 01

H-INDEX: 12

citations: 2057
*As per google scholar on June, 2017

PROFESSIONAL ACTIVITIES

- Life Member, Association of Food Scientists and Technologists (India).
- Life Member, UDCT Alumni Association.

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 (Cicer arietinum) 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 (Eleusine coracana) 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 Aspergillus niger 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 stabilizationAqueous and non-aqueous environment	Process Biochemistry	2008, 43(10):1019- 1032	2.983
10	Effect of -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) – 6
Masters (completed) – 24
Masters (ongoing) –8

RESEARCH PUBLICATIONS

International – 42International (this year)-10
National- 15
Conference Proceedings – 34
Book / Monograph- 1

SPONSORED PROJECTS

Government -3 (Completed)
Private -3 (Completed)

H-INDEX: 12

citations: 527
*As per google scholar on June, 2017

PROFESSIONAL ACTIVITIES

- 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 fibre paratha premixes, high protein atta premix and other healthy low cost nutritious premixes.

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

Food Biotechnology, Principles of Food Analysis, Waste Management in Food Processing, Fermentation Technology, Biochemistry Lab, Technical Analysis Lab

RESEARCH INTERESTS

Food Biotechnology, Bioprocess Technology, Waste Management

RESEARCH STUDENTS

Masters (Completed) – 3

Masters (ongoing) – 3

RESEARCH PUBLICATIONS

International- 5

Conference Proceedings – 1

Book Chapter – 2

H-INDEX: 4*

citations: 58

*As per Scopus on June, 2017

PROFESSIONAL ACTIVITIES

- Life Member, UAA.
- Life Member, Biotechnology Research Society of India (BRSI), India.

HIGHLIGHTS OF RESEARCH WORK DONE AND IT'S IMPACT

Dr. Jyoti works in the area of chiral resolution, waste management, fermentation technology and food product development. Chirality is a ubiquitous concept in nature. It it 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. She has worked on the use of enzymes in non-aqueous media to synthesize enantiomerically pure products of commercial value in pharmaceutical and fine chemical industry. Currently she is working on biosorption of heavy metals from polluted water, fermentation technology and isolation of proteins from unconventional food sources.

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 (±)-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	Enviromental Science and Engineering	Vol 5: Municipal Solid Waste, Pg 290-308	--

DR. SNEHASIS CHAKRABORTY
B.sc., B.Tech., M. Tech, Ph. D (Tech.)
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, Legume rich functional bread, Enzyme based time-temperature indicator

RESEARCH STUDENTS

Masters (ongoing) –03

RESEARCH PUBLICATIONS

International- 19
International (this year)- 03
Book / Monograph- 4
Book chapter: 3
Peer-reviewed- 6

SPONSORED PROJECTS

Government -1 (Ongoing)
Private -1(Ongoing)

H-INDEX: 6*

Citations: 165
*As per Scopus on June, 2017

PROFESSIONAL ACTIVITIES

- Local Executive Committee Member, Association of Food Scientists and Technologists (I), Mumbai Chapter.
- Life Member of Association of Food Scientists & Technologists, India (AFSTI).
- Life Member, Biotechnology Research Society of India (BRSI), India.
- Treasurer of Association of Food Scientists & Technologists, India – Mumbai Chapter (2016-17).

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 (Ananascomosus 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 (Ananascomosus 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 (AnanascomosusL.) 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 (AnanascomosusL.) 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 ENGINERING AND TECHNOLOGY)

- Dr. Smita Kandar, 4B, Annapurna, Anushaktinagar, Mumbai.
- Dr. S.P.Chawla, Scientific Officer, Meat Technology Research Group, Food Technology Division, BARC, Mumbai Ravindra Zende,
- Ms. Tirtha Gala, 602, Hiranandani enclave, tilak mandir road, vile parle (e), Mumbai
- Dr. S. T. Hande, Asst. Prof. , Dept Livestock Production & Management, Bombay Veterinary College, Paral.

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

- Dr. Jayant R. Bandekar, BARC, Trombay, Mumbai – 400 085
- Dr. Rashmi Motey, 403, Gagangiri Avenue, J.K.Gram Post, Near Raymonds, Pokhran Rd.No.1 Samta Nagar, Thane (W).
- Dr. Joseph I Lewis, C-602, Vastu Park, Malad West, Mumbai.
- Dr. Veena Yardi, Associate Professor, College of Home Science, Nirmala Niketan, Mumbai

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 Attendent

Mr. Santosh J. Rajam
Laboratory Attendant

Mrs. Pramila P. Pawar
Laboratory Attendant

MAJOR AWARDS / HONOURS

- Dr. S. Chakraborty received Best PhD Thesis award in Agricultural Engineering across the country given by Indian Council of Agricultural Research in June 2017.
- Prof. S. S. Lele Received Woman Achiever Award given by Akhil Bharatiya Chitpawan Mahasangha, April 2017.
- Prof. S. S. Lele Interviewed for 90 mins at ParleKatta, Diamond Jubilee interview, April 2017.
- Prof. S. S. Lele Delivered 3 talks, total 90 mins on Science Corner in Marathi on FM Rainbow radio, January, 2017.
- Prof. S. S. Lele received National Award **"UnchamazaZoka** (Women Achiever – in Science for society category) given by **Zee Marathi**, 2016.
- Prof. S. S. Lele received "Sri Ganga Ram memorial prize -2016" **Best paper award** by the "Institution of Engineers India" to the paper "A Review on Alternative Carbon Sources for Biological Treatment of Nitrate Waste".
- Ashish Waghmare received the best poster award at "The 7th International Conference on Algal biomass, Biofuel and Bioproducts", organized by Elsevier in Miami, Florida, US, on 18-21st June, 2017.
- Dr. S.S. Arya selected as Young Scientist Award 2016 AFST (I) CSIR, CFTRI campus, Mysore.
- Prof. S. S. Lele received DBT sponsored research project on mushrooms in collaboration with Teri.
- Prof. U.S. Annapure received the Best Teacher Award (Prof.D.V. Rege-AFST Mumbai Chapter-2011 Endowment) 2016.
- Dr. S.S. Arya selected as 2016 ILSI-International Life Science Institute Malaspina International scholar.
- Prof. S. S. Lele and Shanooba P.M. received the first prize for best paper and best invited paper awards-oral papers respectively at international conference on biotechnology for better tomorrow at Tampa USA.

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.	Chandrima Shrivastava	Dry Fractionation of Indian legume protein concentrates	S. Chakraborty
2.	Manjari Mukherjee	Quinoa seeds: chemistry, technology, processing, applications and health benefits	S.S.Arya
3.	Moksha Chib	Cloud point extraction of food bioactives	S.S.Arya
4.	Ameya Pathak	Insects as food sources	R.S.Singhal
5.	Shashank Bansal	Fermented cereal/legume multigrain products	S.S.Arya
6.	Anas Shaikh	Value addition to tropical-exotic fruit waste	S. Chakraborty
7.	Montica Sawant	Waste utilisation from coffee beans	S.S. Lele
8.	Batul Hussain	Recent studies in thermal and non-thermal inactivation of fruit based enzymes	L. Ananthnarayan
9.	Dhwani Mistry	Quorn: chemistry, technology, processing and applications	RSS
10.	Medha Narang	Enzymes in Bakery Products	J.S. Ghokhale
11.	Prathamesh Kudalkar	Preservation of nuts –science and technology	S.S. Lele
12.	Piyusha Patil	Vegetables/ Plant Milk	U.S. Annapure
13.	Mahesh Dudhal	Recent techniques for identification and quantification of adulterants in food systems	L. Ananthnarayan
14.	Dipti Kolte	Trehalose - A Food Additive	U.S. Annapure
15.	Rushabh Gowardipe	Pulsed light treatment of fruit products	S. Chakraborty
16.	Darshan Wavare	Micrencapsulation using extrusion processing	U.S. Annapure
B. TECH. (FOOD ENGINEERING & TECHNOLOGY) PROJECTS			
1.	Chandrima Shrivastava	Developmentof functional bread using fermented pulse-protein	S. Chakraborty
2.	Manjari Mukherjee	Mix Fruit leather	S.S.Arya
3.	Moksha Chib	Development of whey based tropical RTS fruit beverage	S. Chakraborty
4.	Ameya Pathak	Sugar free Indian confection	L. Ananthnarayan
5.	Shashank Bansal	Tea beverage	U.S. Annapure

6.	Anas Shaikh	Development of low-calorie antioxidant rich sapodilla jam	S. Chakraborty
7.	Montica Sawant	Healthy alternatives from Quinoa	S.S.Arya
8.	Batul Hussain	Ginger Lemon juice powder	U.S. Annapure
9.	Dhwani Mistry	Chocolate bar formulations with Jaggery	R.S.Singhal
10.	Medha Narang	Development of snack bar using seeds	J.S. Ghokhale
11.	Prathamesh Kudalkar	Functional bread from basil seed	S.S.Arya
12.	Piyusha Patil	Improved instant idli mix	L. Ananthnarayan
13.	Mahesh Dudhal	Papaya clarified juice and seed oil	S.S. Lele
14.	Dipti Kolte	Chyawanprash with jiggery	R.S.Singhal
15.	Rushabh Gowardipe	Extraction of gums from Sangri and its application in foods	J.S. Ghokhale
16.	Darshan Wavare	Pomegranate beverage and seed oil	S.S. Lele
M.TECH. (FOOD ENGINEERING & TECHNOLOGY) SEMINARS			
1.	Abisheka Pandian T.	Time-Temparature integrator (TTI) indicator	S. Chakraborty
2.	Harshal	Multigrain products in bakery industry	S.S. Lele
3.	Kakoli Pegu	Physicochemical, functional and nutritional characterization of whole wheat flour for its suitability to be used in flat bread: recent updates	S.S.Arya
4.	Kapil Rai	Aerogels	R.S.Singhal
5.	Kishori Balu Panmand	Nutrient & stress management	L. Ananthnarayan
6.	Krutika Anil Bhangale	Modification of gums	U.S. Annapure
7.	Nivedita N.V.	Protein-carbohydrate interaction during food processing	U.S. Annapure
8.	Rishab Dhar	Swelling kinetics of legumes	S. Chakraborty
9.	Shubham Goyal	Degradation kinetic study of fruit/fruit waste polyphenol-recent update	S.S. Arya
10.	Sneha Awasthi	Algal beta-glucan	R.S.Singhal
11.	Saee Nikam	Cashew apple: An overview from agriculture to food processing	S.S. Lele
M.TECH. (FOOD BIOTECHNOLOGY) SEMINARS			
1.	Alisha Sukhija	Applications of sacchromyces cerevisiae in the production of proteins & enzymes	U.S. Annapure
2.	Harsha Jagdish Bharwani	Processing effects on allergen	S.S.Arya
3.	Mukesh Kumar Patel	Oxygen transfer rate in fermentation process	S. Chakraborty
4.	Nitin Sukhdev Sangle	Fermented fruits and vegetables	J.S. Ghokhale
5.	Prabhat Chauhan	Probiotic potential of plant gum on probiotic S.boulardii	U.S. Annapure

6.	Sana Jameel Shaikh	Food products & processes involving solid state fermentation	L. Ananthnarayan
7.	Shaikh Lubna Bagum	Recent trends in packaging of fruits & vegetables	S.S. Lele
8.	Shraddha Srinivasan	Counteracting hangover with food components	R.S.Singhal
9.	Shubham Bharat Gaikwad	Marine nutraceuticals	S.S.Arya
10.	Sumita Kumari	Food and health benefits of exopolysaccharides produced by lactic acid bacteria	L. Ananthnarayan
M. TECH. (BIOPROCESS TECHNOLOGY)			
1.	Vaibhav Kalokhe	General aspects of downstreaming immobilization and industrial application of lipase enzyme	Amit Pratap
2.	Niddhi Kulkarni	Method fermentation-methanol as a product as well as substrate	A.M. Lali
3.	Vasudha Borkar	Upstream production of denosumab from CHO cell line	R.D. Jain
4.	Shyam Mewada	Collagen from non animal sources	Prajakta Dandekar

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.	Rathod Rahul (UGC SAP)	ICT, Mumbai	Development of extruded food product (FET)	July 2011	U. S. Annapure
4.	Giri Shital* (UGC SAP)	LIT, Nagpur	Studies in development of low glycemic index foods (FET)	June 2011	L. Ananthanarayan

5.	Joshi Chetan (UGC SAP)	ICT, Mumbai	Fermentative production and downstream processing of zeaxanthin (BPT)	July 2011	R. S. Singhal
6.	Choudhari Sandeep (UGC SAP)	ICT, Mumbai	Fermentative production, downstream processing and applications of microbial cutinase (BPT)	April 2012	R. S. Singhal
7.	Waghmare Aashish (UGC SAP)	ICT, Mumbai	Extraction of bio-oil and valuable products from microalgae (BPT)	July 2013	S. S. Arya
8.	Bhaskar Bincy* (DBT)	D.Y.Patil, Navi Mumbai	Studies on bioactive peptides from selected legumes commonly consumed in India (FBT)	July 2012	L. Ananthanarayan
9.	Kulkarni Anuja* (UGC-SAP)	D.Y.Patil, Navi Mumbai	Studies in biotechnological aspects of food allergens (FBT)	July 2012	L. Ananthanarayan
10.	Gaikwad Sonali* (UGC-SAP)	MAU, Parbhani	Chemistry and technology of cereal-legume based Indian traditional food (FET)	July 2013	S. S. Arya
11.	Tupe Rupesh (UGC SAP)	ICT, Mumbai	Studies on functional foods (FET)	October 2012	L. Ananthanarayan
12.	Patil Sonal* (UGC SAP)	ICT, Mumbai	Studies on production and characterization of gluten-free flat bread (FET)	July 2013	S. S. Arya
13.	T. Rohit (UGC SAP)	MAU, Parbhani	Studies on effect of cold plasma processing on properties of rice varieties (FET)	December 2012	U. S. Annapure

14.	Purohit Pulkit (UGC SAP)	IICPT, Tamil Nadu	Characterization of jamun and karwand fruits and their utilization in cereal/ fruit bars (FET)	February 2014	S. S. Lele
15.	Sonawane Sachin (UGC SAP)	ICT, Mumbai	Studied on fruit seed pepties and its application in food preservation (FET)	July 2013	S. S. Arya
16.	Arekar Chetan (UGC SAP)	Karunya University, Coimbatore	Studies in tropical fruit wines (FBT)	July 2013	S. S. Lele
17.	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
18.	K. V. Umesh (UGC SAP)	ICT, Mumbai	Enhancing bioavailability of nutraceuticals (FBT)	December 2012	R. S. Singhal
19.	Regubalan Baburaj	Anna University, AICT Campus, Chennai	Studies in microbial characterization, nutritional improvement and preservation of idli batter (FET)	September 2013	L. Ananthanarayan
20.	Shah Nirali Nitin*	ICT, Mumbai	Hydrophobic modification of biopolymers (FET)	May 2014	R. S. Singhal
21.	Desai Mihir Mukund	UICT, NMU, Jalgaon	Studies on indigenous oils and deoiled meals (FET)	September 2013	S. S. Lele
22.	Bhushette Pravin Rajkumar	UICT, NMU, Jalgaon	Study on new exudate gums (FET)	October 2013	U. S. Annapure
23.	Nagavekar Nupur Shantaram*	ICT, Mumbai	Extraction technologies for novel food ingredients (FBT)	May 2014	R. S. Singhal

24.	Sorde Kaurna Liladas*	UICT, NMU, Jalgaon	Studies in fermentative production of microbial Transglutaminase (FBT)	October 2013	L. Ananthanarayan
25.	Kadam Deepak Sunil	ICT, Mumbai	Studies on utilization of Nigella sativum and Lepidiumsativum seed cake (FBT)	May 2014	S. S. Lele
26.	Singhu Bhupender	Shri Ramaswami Memorial University, Chennai	Enhanced production of glutathione (FBT)	October 2013	U. S. Annapure
27.	Bedade Dattatray Kashinath	ICT, Mumbai	Fermentative production, downstream processing and applications of acrylamidase (BPT)	May 2014	R. S. Singhal
28.	Tulamandi Sreedath	TNAU/ Cornell University joint degree	Development of biopolymer films using agricultural biomass	January 2014	R. S. Singhal
29.	Chaudhari Bhushan	North Maharashtra University, Jalgaon	Study on new seed gums(FET)	April 2015	U. S. Annapure
30.	Ketan Mulchandani	ICT, Matunga	In Process(BPT)	July 2013	R. S. Singhal
31.	Abhijit Muley	North Maharashtra University, Jalgaon	Modification of proteins for enhanced functionality(FBT)	September 2015	R. S. Singhal
32.	Seema Bajaj*	ICT, Matunga	Processing and storage stability of added vitamins in food(FET)	September 2015	R. S. Singhal
33.	Sachin Adsare	North Maharashtra University, Jalgaon	Studies in coconut processing (FBT)	April 2015	U. S. Annapure

34.	Anu Ahlawat*	GGS Indraprasth University	Studies in development of milk based beverages(FBT)	In process	L. Ananthanarayan
35.	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
PH.D. SCIENCE [BIOTECHNOLOGY (BT)/ BIOCHEMISTRY (BC)/ FOOD SCIENCE (FS)]					
1.	Subramaniam Jayshree* (UGC SAP)	Ruia College, Mumbai	Fermentative production and downstream processing of fucoxanthian (BT)	Aug 2010	R. S. Singhal
2.	Dabir Mugdha* (UGC SAP)	NMU, Jalgaon	Studies in characterization and deactivation of fruit based enzymes (BC)	June 2013	L. Ananthanarayan
3.	Datta Suprama* (CSIR)	Birla College, Mumbai	Characterization and profiling of Saccharomyces boulardii (BT)	July 2013	U. S. Annapure
4.	Bagul Vaishali *(UGC SAP)	KTHM College, Nashik	Studies in fermentative production and downstream processing of docosahexanoic acid (BT)	August 2013	U. S. Annapure
5.	Insulkar Prajakta* (UGC SAP)	Birla College, Kalyan	Study of production of exopoly saccharide from haloroterant organisms and their biotechnological application (BT)	In-process	S. S. Lele
6.	Rahman Momin Bilal M. (UGC SAP)	Institute of Science, Mumbai	Fermentative production and dowmnstream processing of arginase (BT)	July 2013	U. S. Annapure

7.	Vaidya Aniruddha (UGC SAP)	Dept. of Microbiology, University of Pune	Development of phage-based biosensor (BT)	December 2012	U. S. Annapure
8.	Ghanate Aarti * (UGC SAP)	Shivaji University, Kolhapur	Studies in traditional foods: process and technology development (BT)	December 2012	U. S. Annapure
9.	Bhagwat Ashlesha * (UGC SAP)	K.J. Somaiya College, Mumbai	Studies in probiotics (BT)	December 2012	U. S. Annapure
10.	Jamakhani Majeed (UGC SAP)	SASTRA University, Tamilnadu	Study on isolation and characterization of tomato allergens (BT)	July 2013	S. S. Lele
11.	Vishwasrao Chandrahas (UGC SAP)	Ruia College, Mumbai	Biochemical characterization of selected indigenous fruit varieties during ripening and extended shelf life (BC)	December 2012	L. Ananthanarayan
12.	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
13.	Deorukhkar Anuradha *(UGC SAP)	SIES College,Sion	Biochemical studies and characterization of isoflavones occurring in commonly consumed Indian legumes (BC)	December 2012	L. Ananthanarayan
14.	Bannerji Anamika Amit *	SNDT University, Mumbai	Indian flat breads: physicochemical and nutrituional aspects (FS)	September 2013	S. S. Lele
15.	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

16.	Bakshi Gayatri Girish *	University of Mumbai	Studies in pectinase enzymes and associated inhibitors in selected fruits (FS)	September 2013	L. Ananthanarayan
17.	Mishra Rachna *	University of Allahabad	In Process(FS)	In process	U. S. Annapure
18.	Salve Akshata Raosaheb *	University of Mumbai	Development of peanut based functional foods (FS)	September 2013	S. S. Arya
19.	Dash Pratipanna *	University of Mumbai	Studies on enzymatic protein hydrolysis and characterization of protein hydrolysates (BC)	October 2013	L. Ananthanarayan
20.	Pathan Fayaz Latif	MPKV, Rahuri	Studies on effect of plasma processing on physicochemical properties of legumes (FS)	May 2014	U. S. Annapure
21.	Vernekar Manvi Jayant *	Ruia College Mumbai	Elucidating the gene-diet-disease interaction of polyunsaturated fatty acid metabolism (BT)	December 2012	R. S. Singhal
22.	Sandesh Marathe	Furgusson College, Pune	Enzymatic biotransformation of sugars and polyphenols for enhanced functionality(BT)	November 2017	R. S. Singhal
23.	Amruta Karangutkar*	Khalsa College, Matunga	Studies on extraction , purification, characterization & stabilization of natural pigments(FS)	September 2015	L. Ananthanarayan
24.	Riddhi Sota*	LTMM College, Sion	Studies on enzyme polyphenol oxidase (BC)	In Process	L. Ananthanarayan
25.	Santosh Pradhan	Mumbai University, Kalina	Detection and degradation of AFB, in food commodities and products(BC)	April 2017	L. Ananthanarayan
26.	Mohmad Sajeed Bhat	SLIET, Punjab	In Process(FET)	In Process	S.S.Lele

27.	Nitisha Naik*	Ruia College, Matunga	In Process(FS)	In Process	R. S. Singhal
28.	Sumankumari Maurya*	Delhi University	In process(FS)	In process	U. S. Annapure
29.	Prajakta Sadawarte	Dapoli Agri University, Dapoli	Development of sesame based functional food	In process	S.S.Arya
M.TECH. (FOOD ENGINEERING & TECHNOLOGY)					
1.	Cheryl Fernandes	Karunya University	Development of Multi-Grain functional beverage	April, 2016	S.S.Arya
2.	Vrushti Shah*	A.D. Patel Institute of technology	To study the effect of cereal flour ingredients on rheological & tectural	April, 2016	L. Ananthanarayan
3.	Bulbul Vij*	UAS, Bangalore	Studies on effect of cold plasma treatment on commercial gums	April, 2016	U. S. Annapure
4.	Aroshi Sharma*	Shoolini university, Himachal Pradesh	Studies on isolation and physiochemical characterization of plant gum exadates	April, 2016	U. S. Annapure
5.	Vardan Singh	Tezpur University, Assam	Studies on Rosella and its food applications	April, 2016	S. S. Lele
6.	Swarnali Das*	Jadhavpur University, Kolcatta	Studies in the development of healthfull fruit beverages	April, 2016	L. Ananthanarayan
7.	Divya M*	UAS, Bangalore	Studies on development of functional flat bread incorporated with flaxseed	April, 2016	S. S. Lele
8.	Niharika Soni*	Amity University, Delhi	Modification of guar gum using clodecerul succinic anhydride	April, 2016	R. S. Singhal

9.	Ashwini Kumar	Tezpur University, Assam	Studies on oleogels: formulation functionality & its application	April, 2016	R. S. Singhal
M. TECH. (FOOD BIOTECHNOLOGY)					
1.	Shraddha Sontakke*	Banasthali University	Non-conventional plant growth regulators	April, 2016	R. S. Singhal
2.	Sanjogita Gosavi*	Sihgad college, pune	Studies on fermented functional novel flat bread	April, 2016	S.S. Arya
3.	Vaishali Mishra*	Banasthali University	Studies on beer processing	April, 2016	U. S. Annapure
4.	Deepanshu Garg	PAV, Ludhiana	Development of a functional food product using prosopisoneraria	April, 2016	J.S. Gokhale
5.	Manjusha Joardar*	West bangal university of technology, kolcatta	Integration of biotechnology in food products	April, 2016	S. S. Lele
6.	Saaylee Danait*	D.Y.Patil, New Mumbai	Effect of processing on peanuts	April, 2016	S.S. Arya
7.	Pratiksha Avhad*	KIT College, Kolhapur	Isolation and production of melatonin from saccharomyces boulardii	April, 2016	U. S. Annapure
8.	Rutumbara Haripurkar*	KIT College, Kolhapur	Extraction of caratenoids from plant sources and its applications	April, 2016	L. Ananthanarayan
9.	Priyanka Sawant*	Thadomal Sahani College, Mumbai	Enzyme assisted aqueous extraction of flaxseed oil	April, 2016	R. S. Singhal
10.	Sruthy Thanakudan*	S.I.E.S. College, Mumbai	Studies in the development of sourdough breads	April, 2016	L. Ananthanarayan
M.TECH (BIOPROCESS TECHNOLOGY)					
1.	Bhupendra Thakre	Dr. hari singh gour university, M.P.	Production of cellulose from saccharomyces bourlaraii using food industrial waste	April, 2016	U. S. Annapure

2.	Gyanendrakumar Gautam	Sardar vallabhbhai patel university of agriculture and technology, Meerut	Extraction of carotenoids from micro algae with the help of cloud point extraction method.	April, 2016	S.S.Arya
3.	Rathi Sushilshrinivas	Shivajirao Jondhale College of engineering , Dombivali	Computational studies of anaerobic digester and process optimization	April, 2016	J.S. Gokhale

POST-DOCTORAL FELLOWS RESEARCH PROJECTS

Sr. No.	Post-Doctoral Fellow	Previous Institute	Project Title	Guide
1.	Sadineni Varakumar (UGC-Dr. D. S. Kothari PDF)	Sri Venkateswara University, Tirupati	Evaluation of the role of nutraceuticals as bioenhancers of oral bioavailability of anti-cancer drugs	R. S. Singhal
2.	Kriti Kumari Dubey*	University of Mumbai	Microbial fermentation of Tea	R. S. Singhal
3.	Hemant P. Borse	North Maharashtra university, Jalgaon	Toxicological evaluation of chemically & biologically synthesized nanoparticles	R. S. Singhal
4.	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.	Das Rahel Suchinita*	Studies on protein co-precipitates	R. S. Singhal
2.	Banura Sidhant	Studies on protein co-precipitates	U.S. Annapure
3.	Bhat Yuga Narayan*	Product & process development for utilization of Dill herb(Anethum graveolens) and Drumstick pods	S.S.Lele
4.	Mohurle Ashwini Devidas	Study of functional properties of protein co-precipitate	R. S. Singhal
5.	Jondhale Sunil Kashiram	Studies in isolation and characterization of plant gum exudates	U.S. Annapure
6.	Ghorpade Dhananjay Shankar	Studies on peanut meal incortor bread	S.S. Arya

7.	Jain Rahul	Studies on microwave processing and dehydration of wheat-grass	S.S.Lele
8.	Chaudhary Himanshu	Enzyme active grain flour in novel food applications	L. Ananthanarayan
9.	Meshram Sonakshi Milind*	Studies on development of Indian traditional foods	L. Ananthanarayan
10.	Dargah Krati M. K.*	Omega-3 Enriched functional semi-sweet biscuit with flaxseeds	S. S. Arya
M. TECH. (FOOD BIOTECHNOLOGY)			
1.	Monika Rani*	Studies in biomolecule profiling during the course fermentation of india fermented food	L. Ananthanarayan
2.	Pal Himadri*	Studies on fermented mango products Nata and Wine	S.S.Lele
3.	Tiwari Shweta*	Studies on symbiotic Tea	R. S. Singhal
4.	Kazi Mustafa Khuzema	Studies on fruit vinegars	U. S. Annapure
5.	Meera Chandru*	Development of healthful food products for maternal nutrition	L. Ananthanarayan
6.	Dhaliwal Harleen Kaur*	Studies on food safety of cereal legume based batter	R. S. Singhal
7.	Sutar Swapnil Arun	Studies on the effect of cold plasma treatment on enzyme activity & insect imfestation on whole wheat flour	U. S. Annapure
8.	Singh Pankhuree*	Functional prebiotic beverage from multigrain	S. S. Arya
9.	Jadhav Sunayana*	Fermented probiotic drink from peanut meal	S. S. Arya
M.TECH. (BIOPROCESS TECHNOLOGY)			
1.	Vikrant Bansode	Extraction, concentration and purification from protein peanut meal	S. S. Arya
2.	Farah Naz*	Isolation,purification and characterization of lipase from saccharomyces boulardii	U. S. Annapure
3.	Shinde Priyanka*	Production of tannase and its application for improving chemopreventive potential	J. S. Gokhale
Ph.D. (TECH) [FOOD ENGINEERING AND TECHNOLOGY (FET)/ FOOD BIOTECHNOLOGY (FBT)/ BIOPROCESS TECHNOLOGY (BPT)]			
1.	Palamthodi Shanoba *	Studies on gourd family vegetables with special emphasis on bottle gourd, for their biotechnological applications	S.S.Lele

2.	Surve Vedprakash	Studies in traditional fermented foods	U.S.Annapure
3.	Kar Jayaranjan	Fermentative production, downstream processing and application of glycine betaine	R. S. Singhal

SPONSORED PROJECTS

GOVERNMENT AGENCIES

Sponsor	Title	Duration	Amount	Principal Investigator	Co-investigator
Rajiv Gandhi Science and Technology Commision (RGC)	Exotic tropical fruit wines-microbrewery demo plant	2014-2017	Rs.67.27 lakhs	Professor Smita S. Lele	--
DBT Govt of India	Developing of mushroom germplasma bank for western coast of india with special emphasis on Maharashtra & goa to commericialised their nutraceutical & pharmaceutical potential	2015-2017	Rs.2.71 lakhs	Professor Smita 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	--

PRIVATE AGENCIES

Sponsor	Title	Duration	Amount	Principal Investigator
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

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	Manvi Vernekar
National Chemical Laboratory, Pune	Fermentative production, downstream processing and applications of microbial cutinase	Sandeep Choudhary
Queens University, Belfast, Ireland	Characterisation and profiling of saccharomyces boulardii	Datta Suprama
Paul Ehrlich Institute, Langden	Studies on legume allergens	Anuja kulkarni

RESEARCH PUBLICATIONS

PROFESSOR REKHA S. SINGHAL

Title	Author	Journal
Supercritical carbon dioxide extraction of astaxanthin from Paracoccus NBRC 101723: Mathematical modelling study	Chougle, J. A., Bankar, S. B., Chavan, P. V., Patravale, V. B., & Singhal, R. S.	Separation Science and Technology, 6395(May) (2016), 01496395.2016.1178288. doi:10.1080/01496395.2016.1178288
A biodegradable and edible packaging film based on papaya puree, gelatin, and defatted soy protein	Sreedath Tulamandi, Visvanathan Rangarajan, Syed S.H. Rizvi, Rekha S. Singhal, Sanjay Kr. Chattopadhyay, Narayana Chandra Saha	Food Packaging and Shelf Life, 10: 60-71 (2016)
Modelling and optimization of zeaxanthin production by Paracoccus zeaxanthinifaciens ATCC 21588 using hybrid genetic algorithm techniques	Chetan Joshi, Rekha S. Singhal,	Biocatalysis and Agricultural Biotechnology, 8: 228-235 (2016)

Glycine betaine-mediated protection of peas (Pisum sativum L.) during blanching and frozen storage	Jayaranjan R. Kar, John E. Hallsworth and Rekha S. Singhal	International Journal of Food Properties, 19: 2510-2521 (2016)
Synergism of microwave irradiation and enzyme catalysis in kinetic resolution of (R,S)-1-phenylethanol by cutinase from novel isolate Fusarium ICT SAC1	Kamble, M.P., Chaudhari, S.A.,Singhal, R.S., Yadav, G.D.	biochemical engineering journal, 117, pp.121-128(2017)
Biochemical Characterization of Extracellular Cellulase from Tuber maculatum Mycelium Produced Under Submerged Fermentation	Bedade, D.K., Singhal, R.S.,Turunen, O., Deska, J., Shamekh, S.	applied biochemistry and biotechnology, 181(2), pp. 772-783(2017)
Enhanced extraction of oleoresin from ginger (Zingiber officinale) rhizome powder using enzyme-assisted three phase partitioning	Varakumar, S., Umesh, K.V.,Singhal, R.S.	Food Chemistry, 216, pp. 27-36(2017)
a Study on the Kinetics of Acrylamide Formation in Banana Chips	Mulla, M.Z., Annapure, U.S.,Bharadwaj, V.R., Singhal, R.S.	journal of food processing and preservation 41(1), e12739(2017)
Gene polymorphisms of desaturase enzymes of polyunsaturated fatty acid metabolism and adiponutrin and the increased risk of nonalcoholic fatty liver disease	Vernekar, M., Amarapurkar, D.,Joshi, K., Singhal, R.	Meta Gene, 11, pp.152-156(2017)
Enzymatic extraction and characterization of polysaccharide from Tuber aestivum	Bhotmange, D.U., Wallenius, J.H.,Singhal, R.S., Shamekh, S.S.	Bioactive Carbohydrates and Dietary Fibre,10, pp. 1-9(2017)
Extraction of Flaxseed Oil: A Comparative Study of Three-Phase Partitioning and Supercritical Carbon Dioxide Using Response Surface Methodology	Kulkarni, N.G., Kar, J.R., Singhal, R.S.	Food and Bioprocess Technology, 10(5), pp. 940-948(2017)
A strategic approach for direct recovery and stabilization of Fusarium sp. ICT SAC1 cutinase from solid state fermented broth by carrier free cross-linked enzyme aggregates	Kulkarni, N.G., Kar, J.R., Singhal, R.S.	International Journal of Biological Macromolecules, 98, pp. 610-621(2017)

Development of Par-Fried Frozen Samosas and Evaluation of Its Post-Storage Finish Frying and Sensory Quality	Raj, T., Kar, J.R., Singhal, R.S.	Journal of Food Processing and Preservation, 41(4), e 13049(2017)
Pilot scale production, kinetic modeling, and purification of glycine betaine and trehalose produced from Actinopolyspora halophila (MTCC 263) using acid whey: A dairy industry effluent	Jayaranjan R. Kar and Rekha S. Singhal	Chemical Engineering Science, 163: 83-91 (2017)
Artocarpus lakoocha roxb.: An untapped bioresource of resveratrol from North East India, its extractive separation and antioxidant activity	Hirok Jyoti Borah, Rekha Singhal, Swapnali Hazarika	Industrial Crops and Products, 95:75-82 (2017).

BOOK CHAPTERS:

Title	Authors	Reference
Fermented fruits and vegetables	Nirali N. Shah and Rekha S. Singhal	Current Developments in Biotechnology and Bioengineering Food and Beverages Industry, edited by Ashok Pandey, Guocheng Du, Maria Angeles Sanroman, Carlos Ricardo Soccol and Claude-Gilles Dussap, ISBN: 978-0-444-63666-9, Chapter 3, pp 45-89, published by Elseviers, B. V. (2017).
Enzyme-Assisted Extraction of Bioactives	Sandesh J. Marathe, Swati B. Jadhav, Sandip B. Bankar and Rekha S. Singhal	Food Bioactives: Extraction and Biotechnology Applications, edited by Munish Puri, ISBN: 978-3-319-51637-0 (Print) 978-3-319-51639-4 (Online), Chapter 8, pp. 171-201, Published by Springer International Publishing AG, Switzerland (2017).

PROFESSOR S. S. LELE

Title	Author	Journal
Complete Khoya Replacement in Mango Burfi to Increase Shelf Life: A Case Study	Smita Lele, Tripti Pandey and Shanooba PM	Approaches in Poultry, Dairy & Veterinary Sciences.1 (5).(2017)
Extraction, characterisation and bioactive properties of Nigella sativa seedcake	Kadam,D., Lele, S.S.	Journal of Food Science and Technology.54(12): 3936–3947. (2017)
Effect of addition of enzymatically modified guar gum on glycemic index of selected Indian traditional foods (idli, chapatti).	Shital Giri, Anamika Banerji, S. S. Lele, Laxmi Ananthanarayan	(2017). 11:1-8.
Optimization of reactive dye adsorption on bottle gourd peel	Shanooba Palamthodi and SS Lele	J. of Environ. Chem. Engg., (4), 4299-4309 (2016)

Exotic tropical fruit wines from Garcinia indica and Musa acuminate.	Reena M, Chetan Arekar, S. S. Lele	J. Inst. Brew. 122: 745–753. DOI: 10.1002/jib.379 (2016)

PROF. U. S. ANNAPURE

Title	Author	Journal
Effect of hydrocolloids and process parameters on the extrusion behavior of pearl millet grits	Maitre, A., Rathod, R.P., Annapure, U.S.	International Food Research Journal, 24(4), pp. 1538-1544(2017)
A Study on the Kinetics of Acrylamide Formation in Banana Chips	Mulla, M.Z., Annapure, U.S., Bharadwaj, V.R.,Singhal, R.S.	journal of food processing and preservation, 41(1), e 12739(2017)
Functional and rheological properties of cold plasma treated rice starch	Thirumdas, R., Trimukhe, A., Deshmukh, R.R.,Annapure, U.S.	Carbohydrate Polymers, 157, pp. 1723-1731(2017)
Cold Plasma: an Alternative Technology for the Starch Modification	Thirumdas, R., Kadam, D., Annapure, U.S.	Food Biophysics, 12(1), pp. 129-139(2017)
Rheological analysis of dough prepared with lentil flour at different moistures for production of extruded products	Rathod, R.P., Gaikwad, S.B., Mhaske, S.T., Annapure, U.S.	Journal of Food Measurement and Characterization, 11(1), pp(2017)
Antioxidant activity and polyphenolic compound stability of lentil-orange peel powder blend in an extrusion process	Rathod, R.P., Annapure, U.S.	journal of food science and technology,54(4), pp. 954-963(2017)
Different specificities of two aldehyde dehydrogenases from Saccharomyces cerevisiae var. boulardii	Datta, S., Annapure, U.S., Timson, D.J.	Bioscience Reports, 37(2), BSR20160529(2017)
Influence of cold plasma on the enzymatic activity in germinating mung beans (Vigna radiate)	Sadhu, S., Thirumdas, R., Deshmukh, R.R.,Annapure, U.S.	LWT-Food science and Technology, 78, pp. 97-104(2017)
Physico-chemical properties of low-pressure plasma treated black gram	Sarangapani, C., Yamuna Devi, R., Thirumdas, R., (...), Deshmukh, R.R., Annapure, U.S.	LWT-Food science and Technology, 79, pp. 102-110(2017)
Influence of cold plasma on fungal growth and aflatoxins production on groundnuts	Devi, Y., Thirumdas, R., Sarangapani, C., Deshmukh, R.R., Annapure, U.S.	Food Control, 77, pp. 187-191(2017)

Antioxidant properties and global metabolite screening of the probiotic yeast Saccharomyces cerevisiae var. boulardii	Datta, S., Timson, D.J., Annapure, U.S.	journal of the science of food and agriculture, 97(9), pp. 3039-3049(2017)
Physicochemical properties, protein and starch digestibility of lentil based noodle prepared by using extrusion processing	Rathod, R.P., Annapure, U.S.	LWT - Food Science and Technology, 80, pp. 121-130(2017)
Comparative study of Acacia nilotica exudate gum and acacia gum	Bhushette, P.R., Annapure, U.S.	International Journal of Biological Macromolecules, 102, pp. 266-271(2017)
Effects of hydrogen peroxide, modified atmosphere and their combination on quality of minimally processed cluster beans	Waghmare, R.B., Annapure, U.S.	Journal of Food Science and Technology, 54(11), pp. 3658-3665(2017)

DR. LAXMI ANANTHANARAYAN

Title	Author	Journal
Effect of Heat Processing and Ultrasonication Treatment on Custard Apple Peroxidase Activity and Vitamin C	Dabir, M.P., Ananthanarayan, L.	International Journal of Food Engineering, 13(1),20150209(2017)
Delayed post-harvest ripening-associated changes in Manilkara zapota L. var. Kalipatti with composite edible coating	Vishwasrao, C., Ananthanarayan, L.	Journal of the Science of Food and Agriculture 97(2), pp.536-542(2017)
Edible Composite Coating of Methyl Cellulose for Post-Harvest Extension of Shelf-Life of Finger Hot Indian Pepper (Pusa jwala)	Chaple, S., Vishwasrao, C.,Ananthanarayan, L.	Journal of Food Processing and Preservation, 41(2), e12807(2017)
Comparative inactivation studies of Aegle marmelos (bael) peroxidase in crude extract of fruit by heat processing and ultrasonication treatment	Dabir, M.P., Ananthanarayan, L.	Journal of Food Measurement and Characterization, 11(2), pp. 417-422(2017)
Effect of addition of enzymatically modified guar gum on glycemic index of selected Indian traditional foods (idli, chapatti)	Giri, S., Banerji, A., Lele, S.S.,Ananthanarayan, L.	Bioactive Carbohydrates and Dietary Fibre, 11, pp. 1-8(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)
Effect of thermosonication on peroxidase, pectin methylesterase activities and on bioactive compounds in custard apple juice	Dabir, M.P., Ananthanarayan, L.	Journal of Food Measurement and Characterization, 11(4), pp. 1623-1629(2017)
Starch digestibility and glycaemic index of selected Indian traditional foods: Effects of added ingredients	Giri, S., Banerji, A., Lele, S.S.,Ananthanarayan, L.	International Journal of Food Properties, 20, pp. S290-S305(2017)

DR. S. S. ARYA

Title	Author	Journal
Low Glycemic Index Bhakri: Indian -sorghum unleavened Flat Bread	Badgujar, J., Gaikwad, S	Journal of Food Measurement and Characterization11(2), 768-775 (2017)
Fractionation and reconstitution of whole wheat flour and its effect on dough and chapatti quality	Shalini Arya, Laxmi Ananthanarayan, Lambert Rodrigues, Ashish Waghmare	Journal of food measurement and characterization(2016),DOI:10.1007/s11694-016-9345-9
Optimization of ingredients and process formulations on functional, nutritional, sensory and textural properties of thalipeeth: Indian multigrain pancake	Sonali Gaikwad, Shalini S Arya	Journal of Food Processing and Preservation(2017),41(4) e12993
Utilization of banana chips industry waste for production of bio-ethanol	Waghmare AG and Arya SS	Bioethanol 2, 146-156 (2016).
Concentration and characterization of microalgae proteins from Chlorella pyrenoidosa	Ashish G. Waghmare, Manoj K. Salve, Jean Guy LeBlanc, Shalini S. Arya	Bioresource and Bioprocessing, 3:16(2016)
Influence of additives on dough rheology and quality of Thepla: an Indian unleavened flatbread	Sonal P. Patil, Shalini S. Arya	(2016).. Journal of food measurement and characterization, 10 (2), 327-335.(IF: 0.286)

Functional and antioxidant activity ofZiziphus jujube seed protein hydrolysates	Ketaki D. Kanbargi, Sachin K. Sonawane, Shalini S. Arya	(2016),Journal of food measurement and characterization, 10 (2), 226-235.(IF: 0.286)
Impact of fibre mixture on dough and chapatti quality using D-optimal response surface methodology	Shalini S Arya, sachin K Sonawane	Journal of Microbiology, Biotechnology and Food Sciences(2016), 5 (5).
Nutritional, Functional, Thermal and Structural characteristics of Citrullus lanatus and Limoniaacidissima seed flours	Sonawane, S.K., Bagul, M.B., LeBlanc, J.G., Arya S. S.	Journal of food measurement & characterization10(1) 72-79(2016)
Effect of banana peel powder on bioactive constituents and microstructural quality of chapatti: unleavened Indian flat bread	Ankeeta Kurhade, Sonal Patil, Sachin K. Sonawane, Jyotsna S. Waghmare, Shalini S. Arya.	Journal of food measurement and characterization(2016), 10 (1), 31-41.(IF: 0.286)

DR. SNEHASIS CHAKRABORTY

Title	Author	Journal
Changes in quality attributes of high pressure and thermally processed pineapple (AnanascomosusL.) puree during storage	Chakraborty, S., Rao, P.S., & Mishra, H.N.	Food and Bioprocess Technology(2016), 9(5), 768-791.
Empirical model describing the stability of fruit bromelain in pineapple during high-pressure and thermal treatments	Chakraborty, S., Rao, P.S., & Mishra, H.N.	Innovative Food Science and Emerging Technologies(2016), 33, 10-18.
Inactivation kinetics of the most baro-resistant enzyme in high pressure processed litchi based mixed fruit beverage	Jayachandran, L. E., Chakraborty, S., & Rao, P. S.	Food and Bioprocess Technology(2016), doi: 10.1007/s11947-016-1702-5.

BOOK CHAPTERS

Title	Authors	Reference
Effect of Combined High Pressure-Temperature Treatments on Bioactive Compounds in Fruit Purees	Chakraborty, S., Swami Hulle, N. R., Jabeen, K., & Rao, P.S.	In Jorge Moreno (Ed.), Innovative Processing Technologies for Foods with Bioactive Compounds, Chapter 5, pp. 105-131(2016) CRC Press, Boca Raton.
High Pressure Processing of Fruit Juice and Puree	Chakraborty, S., Kaushik, N., & Mishra, H. N.	In H. N. Mishra (Ed.), (2016) Novel Food Products and Process Technologies: Value Addition and Shelf Life Extension. New India Publishing Agency, New Delhi, India.

Mathematical Models and Methodologies for Product Formulation and Shelf Life Evaluation	Shajie, D., Upadhyay, R., Chakraborty, S., & Mishra, H. N.	In H. N. Mishra (Ed.), Novel Food Products and Process Technologies: Value Addition and Shelf Life Extension. New India Publishing Agency, New Delhi, India.

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	Dean, ICT (Reaserch and consultancy) 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 Member, Senate Body, Board of Governors
6.	Dr.Jyoty S. Gokhale	-	Warden Hostel No. 3
7.	Dr. Snehasis Chakraborty	-	Member, Canteen & catering

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

SEMINARS/CONFERENCES ATTENDED

PROFESSOR S. S. LELE

- Attended a seminar on Prof. D.V. Rege memorial seminar nutraceuticals-science to business under tequip program supported by worldbank held on 15th February, 2017 at hotel Peninsula grand, Andheri, Mumbai.
- Resource person in UGC refresher course, Bioreactors and challenge in scale up of food bioprocessing March 1 2017, university Mumbai.
- XIII Triennial national conference of Indian woman scientist association on "Sustainable development India: Role of S & T". Delivered lecture on fruit & vegetable processing 4th Dec 2016.

DR. UDAY S. ANNAPURE

- Attended a training programme on "Non thermal processing of food" at centre for advance faculty training(CAFT) at ICAR, central institute of agricultural university Bhopal on 27 feb 2017
- Attended a training programme on "Extrusion processing" at centre for advance faculty training(CAFT) at ICAR, central institute of agricultural university Bhopal on 27 feb 2017
- Attended a seminar on Preparative processing and analysis of biochemicals and biopharmaceuticals organized by DBT-ICT center under TEQIP-II program supported by World Bank held on 14-18th March, 2017 at KV auditorium, ICT.
- Attended a seminar on Prof. D.V. Rege memorial seminar nutraceuticals-science to business under tequip program supported by World Bank held on 15th February, 2017 at hotel Peninsula grand, Andheri,Mumbai.
- Attended a National Conference on Innovative Trends In Oleochemicals, Surfactants And Personal Care Products supported by TEQIP II organized by Dept. of Oils, Oleochemicals and surfactants technology, ICT, on 6th March, 2017 at ICT, Mumbai.

DR. LAXMI ANANTHANARAYAN

- Attended a conference on food safety arranged by Annapurna-FICCI
- Attended training program at icrisat, hyderabad on aflatoxin detection by elisa method

DR. SHALINI S ARYA

- Attended a Workshop on Food Entrepreneurship Development" organized by FETD, ICT & AFSTI (Mumbai Chapter), ICT Mumbai, Aug 12, 2016
- Attended a Workshop on Fruits and Vegetable Processing Opportunities in Maharashtra, ICT Mumbai Sep 27, 2016.

DR. SNEHASIS CHAKRABORTY

- Attended a seminar on Prof. D.V. Rege memorial seminar nutraceuticals-science to business under tequip program supported by world bank held on 15th February, 2017 at hotel Peninsula grand, Andheri , Mumbai.
- Attended a seminar on Preparative processing and analysis of biochemicals and biopharmaceuticals organized by DBT-ICT center under TEQIP-II program supported by world bank held on 14-18th March, 2017 at KV auditorium, ICT.
- Attended a National Seminar on Nutraceuticals-Challenges & Opportunities, "Nutraceutical potential of plant based foods" organized by D.Y.Patil Institute of Pharmaceutical science and Research at Pune, on 20-21 January, 2017.
- Attended a National Seminar on Technologies in sustainable food systems(TSFS-2016), "high pressure pasteurization of fruit products: Integrating kinetics into process optimization" at SLIET, Longowal on 7-8 october, 2016.

SPECIAL LECTURES / VISITS

PROFESSOR REKHA S. SINGHAL

1. Food safety from farm-to-fork: some realities, challenges, constraints and regulatory framework, a lecture delivered at 25th Indian Convention of Food Scientists and Technologists (ICFOST-XXV), held at Guru Nanak Dev University, Amritsar, Punjab, November 10-12, 2016.
2. Making agriculture pro-nutrition, a lecture delivered at Prof. Jamuna Prakash Felicitation Function, University of Mysore, February 18, 2017.
3. Bioavailability of nutraceuticals: some insights, a lecture delivered at the TEQIP organized workshop on 'Hands on Training for Analysis of Food Bioactives', March 3, 2017.
4. Woman: A salute to the centre of gravity of our existence, a lecture given at Babasaheb Ambedkar Technological University, Lonere, on the occasion of International Women's Day, March 8, 2017.
5. Microbes and depression: a deep connect: a lecture delivered at 7th Interdisciplinary Research Conference, Krishna Institute of Medical Sciences Deemed University, Karad, March 9, 2017.
6. Valorization of food processing wastes, a plenary lecture delivered at UGC SAP National Seminar on Research Trends in Food Processing: Value Addition and Enterprise Development (RTiFP-2017), Tezpur University, March 27, 2017.

PROFESSOR S. S. LELE

1. Delivered an Engineers day celebration lecture on career selection and positive thinking at Singhgad College on 20 September 2016.
2. Chief Guest, for felicitation program under IQAC (Internal quality assurance committee) and delivered lecture on holistic approach on health and nutrition at Modern college, Vashi, on 19 September 2016.
3. Delivered a lecture on appropriate career selection at ST Xavier's college, Mumbai, on 20 august 2016.

DR. UDAY S. ANNAPURE

1. Invited guest of honour Teqip II sponsored National conference on Technologies in Sustainable food systems (TSFS - 2016) organized by Dept. of food engg. And technology, SLIET Longowal University, Punjab on 7-8 October 2016
2. Invited to talk on Plasma processing of materials a workshop organized by Dept. of Physics, ICT, on 21st September 2016 at ICT, Mumbai.
3. "Soy Based Extruded Products" an invited talk delivered at USSEC conference on "Soy: Avenues and Opportunities" organized by American Soybean Association and US Soybean Export Council, at Ahmedabad, Gujarat on February 28, 2017.
4. "Soy Based Extruded Products" an invited talk delivered at conference on "Soy Nutrition and Soy Opportunities – Creating Linkages organised by USSEC in collaboration with the Association of Food Scientists and Technologist, Soy Food Promotion and Welfare Association and Soy Processors Association of India at Hotel Taj Santacruz, Mumbai on the Dec 28, 2016.
5. "Cold Plasma Processing" an invited talk at the World Food Day seminar organised by Department of Food Processing Technology, A.D. Patel Institute of Technology, New VallabhVidya Nagar, Anand - 388 121 Gujarat.
6. "Non-Thermal Process - Emerging Technologies for Food Processing" an invited talk delivered under TEQIP at Department of Technology, Shivaji University, Kolhapur on September 14, 2016.

DR. SNEHASIS CHAKRABORTHY

1. Delivered a guest lecture on advanced thermal and nonthermal processing of food to M.Tech. Sudents at KK wagh College, Nashik, on 26 August, 2017.
2. Give training on sprey drying: operating principles and design criteria at Sunpharma industries Ltd.

Delhi on 5-6 July, 2017.

3. Give training on Advanced Food Processing Techniques to Masters students at Centre of food technology, Allahabad on 14-15 May 2017.
4. Give Hands on training for analysis of food bioactives,"statistical techniques applied in analysis of food bioactives" at ICT Mumbai on 2-4 march, 2017.

ORAL/POSTER PRESENTATIONS

PROFESSOR REKHA S. SINGHAL

- A poster presented at 25th Indian Convention of Food Scientists and Technologists (ICFOST-XXV), "Calcium fortified rice extrudates with improved physicochemical properties and in vitro bioavailability", Madhura Janve, Amruta Bawane and Rekha S. Singhal, held at Guru Nanak Dev University, Amritsar, Punjab, November 10-12, 2016.

PROFESSOR S. S. LELE

- Incorporation of nata demango in beverage, Manjusha Jordar and S. S. Lele, a poster presented at International conference for current trends in biotechnology at Vellore Institute of technology university, Chennai on December 2016.

DR. UDAY S. ANNAPURE

- **Following posters were presented at National conference on Technologies in sustainable food system (TSFS-2016) organized by Department of food engineering and technology, sant longowal institute of engineering & technology, Longowal, Distt, Sangrur, Punjab on7-8 , October 2016.**

1. Isolation and physico-chemical characterization of premus domestica gum exudate, Aroshi Sharma & U.S. Annapure
2. Isolation, purification & characterization of terminalia bellerica plant exudate gum, Bhushette P.R. and U.S. Annapure
3. Studies in increasing the yield by new purification method, characterization and rheology of moringa oleifera gum, Jondhale SK, Bhushette PR and U.S.Annapure
4. Vegan coconut milk powder: an alternative food for milk protein allergic group, Sachin Adsare and U.S.Annapure
5. Effect of cold plasma trerment on xanthan gum functional properties, Bulbul Vij and U.S.Annapure

- **Following posters were presented at ICFoST-XXV organized AFST(I)-HQ and Guru nanak dev university, Amritsar, Punjab on 10-12, November 2016.**

1. Isolation and physic-chemical characterization of Acacia catechu gum exudate, Aroshi Sharma & U.S. Annapure
2. Effect of sugar and salt on emulsion and rheological properties of Lannea coromandelica (Moi), Jondhale SK, Bhushette PR and U.S.Annapure
3. Effect of cold plasma treatment on characteristics and emulsifying properties of xanthan gum, Bulbul Vij and U.S.Annapure
4. Effect of cold plasma treatment on barley, Mishra V. and U.S.Annapure
5. Production of glutathione from S. boulardii, B. Singu and U.S.Annapure
6. Production & isolation of melatonin from S. boulardii , Pratiksha Avhad and U.S.Annapure
7. Effect of cold plasma treatment on barley, Vaishali and U.S.Annapure
8. Isolation, purification and physicochemical properties of kapok gum, Bhushan chaudhari , Bhushette PR and U.S.Annapure

DR. LAXMI ANANTHANARAYAN

- **Following posters were presented at Biotechcellence'16 National conference organized Department of biotechnology, Anna University, Chennai, 1st-3rd April 2016.**

1. Extraction of β-ODAP free protein from grass pea (lathyrus sativus)' by pratipanna dash, laxmi ananthanarayan.
2. Biogenic amines profiling during the course ofidli batter fermentation' by baburaj regubalan, laxmi

ananthanarayan.

3. Effect of partial replacement of rice with ragi on progress of fermentation of idli batter and the end product quality' by Monika Rani, laxmi ananthanarayan.
4. Development of nutrient-rich food products using natural fortification to prevent maternal undernutrition' by meera c., laxmi ananthanarayan.
5. Development of nutrient-rich food products using natural fortification to prevent maternal undernutrition' by himanshu chaudhary, laxmi ananthanarayan

DR. SHALINI ARYA

1. Presented a poster on Effect of growth conditions of on biomass, lipid and carotenoid production and its characterization, Waghmare A. G. and Arya S. S. at International Conference on Sustainable Development for Energy and Environment, Pune on 16-17th January, 2017.
2. Presented a poster on Development of multigrain pancake: Rheological evaluation of dough and pancake quality, Sonali Gaikwad, Arya S.S.at International conference, Topical Research Meeting on Physics in Food Manufacturing, SheiffeildHallam University, London, UK on 9-10th January, 2017.

DR. SNEHASIS CHAKRABORTHY

1. Chakraborty, S., Rao, P.S., &Mishra, H.N. (2016). Pulse and Static high pressure inactivation kinetics of bromelain in pineapple puree. Presented in International conference on Emerging Trend in Agricultural & Food Engineering (ETAE) at IIT Kharagpur, India (27-30 December, 2016).

SEMINARS / WORKSHOPS ORGANIZED

- Food engineering and technology department organised national seminar on opportunities & challenges of foreign direct investment(FDI) in food retail india on 9th dec 2016 at ICT, Matunga, Mumbai.
- Food engineering and technology department jointly with AFST Mumbai chapter have organized a workshop to showcase ICT FETD success stories & bringout opportunities for fruit & veg processing in india for youngsters dreaming entrepreneurship & SME & farmers on 27 September, 2016 at ICT, Matunga, Mumbai.
- A workshop on "Entrepreneurship Development: Dare to dream" is being organized by Food Engineering and technology department under TEQIP-II on August 12, 2016 in KV Auditorium. It is in collaboration with AFST(I) Mumbai Chapter .
- Food engineering and technology department jointly with AFST Mumbai chapter have Organised Prof. D.V.Rege Memorial seminar Nutraceuticals-Science to Business under TEQIP-II program supported by world bank held on 15th February, 2017 at Hotel Peninsula Grand, Andheri, Mumbai.
- Food engineering and technology department organized a workshop on Hands on training for analysis of food bioactives supported by TEQIP-II on 2-4th March, 2017 in KV Auditorium, ICT
- Prof. S.S.Lele organized a one day workshop organized jointly with Trilok Food, Satara on "Fruits and Vegetable Processing Opportunities in Maharashtra on 27th September 2016 at ICT. The program was supported by TEQIP. Over 50 potential entrepreneurs and 30 students attended the program. This was spin of the tremendous curiosity raised in common public when Prof. Lele received the Zee Marathi Award for the technology transfer and start up mentorship in F and V processing. In addition to Prof Lele's elaborate presentation on the topic, there were 5 more speakers having different expertise and they delivered talks on Marketing, Regulatory, Finance and other business aspects.

INDUSTRIAL CONSULTANCY

Company	Area of Advice	Period
SreeBhagyalakshmiAgro foods, Bangalore	Expert opinion on development of low GI Rawa and rice flour	May-17
Maximus Buildcom	Expert opinion on fruit leathers	May-17
TCS, Pune	Low GI and lactobacilli for wellness food	May-17
Aditya Food Industries, Kerala	GI values of rice flour and wheat flour blends	2017
Sawardevalley food foundation Chiplun	Non-grape fruit wine and other fruit processing activities.	2016

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: Shital Giri
Research Supervisor:
Dr. Laxmi Ananthanarayan

Studies in development of low glycemic index foods

Glycemic index is a system which classifies carbohydrate based foods according to their ability to elicit blood glucose response. Cereal based foods which are a major source of energy in the daily diet of people worldwide. Contain starch as the main carbohydrate component. The rate and extent of starch digestion have nutritional significance, particulary for a population with high prevalence of lifestyle diseases like diabetes. The prevalence of type 2 diabetes is increasing rapidly across the world, particularly in Asian contries like india and therefore, there is a need to develop low glycemic index(GI) foods or modify existing popular foods to lower their GI. Hypoglycemic foods have been shown to play a positive role in the prevention and management of type 2 Diabetes mellitus, obesity, cardiovascular diseases, hyperlipidemia and hyperchlolesterolemia.

Optimization of methods to determine starch digestibility, glucose release and glycemic index of foods:
Standardization of in vitro starch digestibility and in vitro glycemic index (GI) has been carried out for wheat based products like bread and chapatti and rice based products like idli and dosa sample size and quantity of enzyme to be taken for analysis was optimized. The effect of chapatii morsel size on starch hydrolysis and glycemic index was also studied. It was found that there was inverse correlation between morsel size and GI value.

Effect of various constituents added on glucose release/ starch/digestibility/ glycemic index and product formulation based on these concepts:

In this study the effect of addition of selected ingredients (barley, oats, gluten and guar gum) on in vitro starch digestibility and in vitro glycemic index GI of flour Indian traditional foods- idli, dosa, upma, and chapatii was investigated. Oats and guar gum were more digestive in reducing starch digestibility and GI. Incorporation of oats(9%) decreased GI of idli, dosa, upma and chapatti by 22.67%, 17.79%, 15.43% and 19.88% respectively reduction in GI by addition of guar gum (5%) was found to be 15.82% for idli 17.76% for dosa16.59% for upma and 18.08% for chapatii. A strong positive correlation was observed between rapidly digestive starch (RDS) and GI while slowly digestible starch (SDS) and resistant starch (RS) had a strong negative correlation with GI.

Effect of solid state enzymatic modification of selected hydrocolloids (food polymers) on their ability to modify

glycemic index of selected traditional foods when incorporated in these foods:

In this study solid state enzymatic modification with mannanase was carried out to improve viscous properties of guar gum. The effect of addition of modified guar gum on fuctional properties sensory acceptability and GI of two Indian traditional products rice based idli and wheat based chapatii was explored. Texture and sensory attributes of both the products with 5% modified guar gum were found to be acceptable. GI of idli was reduced from 71.28 (control) to 60.00(5% UGG) and 61.63 (5% MGG). GI of Chapatii was reduced from 62.50(control) to 51.25(5% UGG) and 53.45 (5% MGG) by addition of unmodified(UGG) and modified guar gum MGG respectively.

Evaluation of microwave cooking verses conventional cooking followed by storage and its effect on glycemic index of foods:

Microwave cooking of foods of gaining in popularity across the country especially in urban sectors of our population in this study, glycemic index of staple foods like rice, tur dal, potato. Khakra cooked by microwave was determined and a comparison was made with GI of these foods, both microwave cooked and conventionally cooked was also evaluated. GI values of all the products were found to be significantly less on microwave cooking as compared to conventional cooking.

Research Scholar: Rohit T.

Research Supervisor: Prof. U.S. Annapure

Studies on effect of cold plasma processing of rice varieties

Cold plasma processing is considered as one of the emerging technology in the food processing. It is used for sterilization, functionalization, inactivation of enzymes, altering the hydrophilic/hydrophobic properties, deposition of packaging films etc. In the proposed research work the primary focus was to study the effect of cold plasma processing on the properties of rice varieties with special emphasis on cooking and textural properties. This covers the studies on cooking, textural and functional properties of cold plasma treated rice varieties (i.e. basmati and brown rice), rice bran and rice starch at different power levels (30 W, 40 W, 50 W, and 60 W) and two treatment times (5 and 10 min). By evaluating the proximate composition, it was concluded that the cold plasma has no significant effect on the nutrition value. SEM, contact angle and surface energy analysis were done to study the changes in surface morphology of plasma treated rice varieties. It was observed that after the plasma treatment the cooking time was reduced significantly from 29.1 min to 21.1 min and 20 min to 13 min in brown rice and basmati rice respectively with respect to plasma power and time of treatment. The increase in the degree of gelatinization of the cooked samples supported the decrease in cooking time. The water uptake was increased from 2.2 to 2.36 g/g in brown rice after the treatment. Textural parameters revealed that there occurs a decrease in hardness and chewiness in both rice varieties. The extent of plasma treatment was observed as a decrease in contact angle and increase in surface energy, making the surface more hydrophilic and thus rice grains absorbs more water resulting in lesser cooking time. Based on the results, it can be concluded that plasma application can significantly change cooking and textural properties of rice varieties. Crosslinking, depolymerization, etching and oxidation are the important mechanism responsible for starch modification. The changes in amylose content, turbidity, pH, water and fat absorption of rice starch were evaluated. The decrease in the turbidity and pH after the treatment was observed. Gel hydration properties and syneresis study revealed that there is an increase in leaching of amylose molecules after the treatment. Rapid visco analyzer examination showed an increase in pasting and final viscosities. From G' and G" moduli determination we observed that there is a decrease in retrogradation tendency of starch gels. XRD analysis revealed no significant difference in the crystalline structure of brown rice, basmati rice and rice starch after the plasma treatment. The cold plasma effect on total polyphenolic content, antioxidant properties, and fatty acid profile of rice bran was evaluated. There is a significant

increase in total polyphenolic content and antioxidant properties after the treatment. There is a decrease in oryzanol content (up to 50%), this is might be due to degradation or breakdown of oryzanol structure by plasma reactive species. There is decrease in unsaturated fatty acids (linoleic acid content 42% and oleic acid 5%) after the treatment. The optimization of process parameters for the preparation of instant rice was carried out. The optimized instant rice is further treated with cold plasma at 60 W for 10 min. Cooking time and rehydration ratio, textural properties were analyzed for the freshly cooked rice, rehydrated instant rice and rehydrated cold plasma treated instant rice. The instant rice – ready to eat can be consumed by just adding boiling water and kept for 4.8 min for rehydrated instant rice and 4.2 min for rehydrated instant cold plasma treated rice respectively. From this, we can conclude that the cold plasma application of rice can enhance the cooking and textural characteristics without any significant change in the nutritional profile.

Research Scholar: - Sonal Patil
Research supervisor: Dr. Shalini Arya

Studies on production and characterization of gluten-free flatbread

The current health issue for many people involves the consumption of gluten i.e. celiac disease which manifests with permanent gluten intolerance. Flatbread (chapatti) is a stable food of india made from whole wheat. Gluten is a major and unique protein giving the important structural properties and quality to the chapatti. Development of flatbread in the absence of this wheat gluten is a technical challenge. Hence, present study was aimed at the development and characterization of gluten free flatbread (GFFB).

1. **Screening of ingredients used for development of GFFB:** the main challenge in the preparation of GFFB is to achieve the requisite elasticity which differs significantly from other bakery products. Hence, flours from various sources were screened viz; rice, sorghum, moong, amaranth, sama, ragi, water chestnut (WCF), buckwheat, soy, tamarind kernel, chickpea, blackgram and unripe banana (UBF) flours during the optimization and preparation of GFFB. The screening criterions used were: dough making ability, rollability, puffing and sensory overall acceptability. Based on these criterions rice and sorghum, unripe banana, water chestnut and moong flours were used to substitute wheat in preparation GFFB as they possess higher levels of similarities with wheat flour as shown by PCA and HCA clusters.
2. **Characterization of gluten free flours to be used for the development of GFFB:** while the preparation of any food, knowledge of physicochemical, functional and rheological characteristics of ingredients are important to predict the final product with desirable qualities and simplify processing. Gluten-free flours except sorghum have lower density, carr's index and hausner's ration compared to wheat. Gluten free flours were characterized by high cohesiveness and poor flowability. The study of bioactive constituents showed their higher concentration in UBF and WCF compared to wheat. XRD study revealed their varying crystallinity patterns and d spacing values as compared to wheat. All the samples except UBF exhibited good pasting properties making them suitable for different food formulations. Gluten free samples were inferior in viscoelastic properties than wheat flour but MF. All the flours were found to have thixotropic behavior.
3. **Development and characterization of GFFB:** mixture design tool (D-optimal design) was employed in the development of GFFB. Above selected flours were used for the purpose and response variables were dough stickness and dough strength along with flatbread characteristics like tear force and sensory overall acceptability. GFFB prepared from a mixture of rice (60%), sorghum (10%), WCF(15%), UBF(5%) and moong flour (10%) showed

better dough stickiness (32.36g) and strength (1.56g), tear force (420.33g) and sensory acceptability (7.3) thus showed great potential for commercial application. Gluten free flour mixture thus developed had similar structural rigidity and similar viscous behavior along with shear dependency as that of whole wheat flour.

4. **Improvement in quality of GFFB and development of additive premix:** simplex centroid design with 15 model points was used for the study. Preselected additives (guar gum, xanthan gum, sodium stearoyl-2-lactylate(SSL)and glycerol monostearate (GMC)) were the independent variables and responses analysed were dough characteristics (stickiness, strength, hardness, elasticity, gumminess) and flatbread characteristics (tear force, hardness,elasticity, chewiness, resilience). It was found that guar gum (0.8%), xanthan gum(0.3%) and GMS (0.9%) hence called as additive premix when added imparted gluten free dough and GFFB Best rheological and textural properties).

5. **Study of effect of ingredients and modified flours on the characteristics of GFFB:** preliminary studies were carried out by incorporation one ingredient (additive premix, proteins) and modified flours (extruded and germinated flours) at a time. It was found that extruded flours made from low density and high expanded extrudete improved the GFFB properties. Hence, part of the study was carried out for the development of gluten free extruded snack which was further ground to flour and was used in GFFB preparation and analysed.

5a. **Development of gluten free extruded snack:** distance based design of response surface methodology was employed which involved use of two variables at five different stages with six central points. Feed moisture and die temperature were independent variables. Low density (a desirable characteristic of expanded product) was achieved at medium levels of feed moisture (16%) and moderate die temperature (1600C).

5b. **Study of effect of ingredients and modified flours on the characteristics of GFFB:** central composite design of response surface methodology was employed. Independent components of the mixture included additive premix extruded flour, germinated flour and whey protein. Dough stickiness increased with increase in additive premix proportion as well as with increase in whey protein. Germinated flour and whey proteins led to an increase in the dough strength of gluten free formulation. A significant decrease in tear force of GFFB was observed when additive premix was added in increasing proportion. Extensibility increased tremendoudsly with the increased proportion of additive premix and whey protein.additive premix (1.5%), extruded flour (10%), germinated flour (20%) and whey proteins (6%) were helpful to produce dough with improves values for stickiness (39.09g) and strength (2.14g) softer (tear force, 224.67g) and bright colored (L value, 40.90) GFFBs.

6. **Inhibition of staling in GFFB:** staling is the major problem associated with GFFB. Three hurdles were employed for the inhibition of staing viz. addition of additive premix, application of edible coating and low temperature storage. In the present study, it was seen that surface coating when done during baking yield better quality GFFB compared to the surface coating treatment performed post baking (sensory acceptability 6.97 and 6.8 respectively). groundnut oil coating was used based on quality retention properties (sensory acceptability 6.72) and fuzzy logic calculations of sensory data. During staling quality of GFFB deteriorates very fast as compared to whole wheat flour flatbread. Staling rate was successfully retarded with the help of addition of additive premix, oil coating on the surface of the

GFFB during baking and refrigeration temperature storage. It can be stated as GFFBs prepared with added additive premix followed by groundnut oil coating was fresh flatbread alike characteristics when stored at refrigeration temperature at the end of 192 hrs. (moisture content 36.65%, tear force 263.83g, water soluble starch 11.06%, phenolic compounds 8.50mg/g GAE, antioxidant activity 1.72%).

PH.D. (TECH) (FOOD BIOTECHNOLOGY)

Research Scholar:- Anuja Kulkarni

Research supervisor:Dr. Laxmi Ananthanarayan

Studies on biotechnological aspects of food allergens

Food allergy is increasing in prevalence in Western populations, but little is known about it in Asia. Asia is unique because of the different cultures and eating habits with the involvement of unique food allergens. In India, majority of the population consumes vegetarian diet made up of pulses (legumes), cereals, and vegetables. In contrast to many western countries, chickpea preparations are consumed in large quantities in India. Allergy to chickpea or Garbanzo bean (Cicer arietinum) has been reported in the Indian population but little information is found regarding allergenic events involved in the chickpea allergy. Hence chickpea allergenicity assessment has been considered in this work.

- By means of **in silico analysis** of the proteome sequence, a proteome-wide analysis of allergens from Fabaceae families was conducted and putative allergens from Chickpea (Cicer areitinum) were identified. From the identified seven putative allergens including Q9SMK8, Q39450, Q9SMJ4, Q304D4, G1K3R9, G1K3S0 and O23758 first four of the listed allergens also showed putative cross reactivity with known allergens.
- **Optimization of protein extraction** using 10 different protocols and **standardization of immunological techniques** likeImmunodiffusion,Radial Immunodiffusion, Rocket Immunoelectrophoresis, SDS-BLOT, DOT-BLOT and ELISA was performed for identification of allergens from chickpea. **Sensitization profile** of the sera from chickpea allergic patients (Spanish and Indian) and sera from pollen and peanut allergic patients (European) confirmed the reactivity of the chickpea extract with the sera and multiple proteins from chickpea were seen to be reactive.
- On the basis of in silico analysis, Bet v 1 like allergens (Q9SMK8 - Cic a 1.01, Q39450 – Cic a 1.02) and nsLTP like allergen (O23758 – Cic a LTP) from chickpea were selected for further assessment of allergenicity. **Recombinant allergen production and characterization** was performed for the above selected putative allergens. **Allergenicity assessment** of the recombinant allergens was performed using the sera described above. Bet v 1 like allergens (rCic a 1.01 & rCic a 1.02) from chickpea were seen to be minor allergens in Spanish chickpea allergic patients while rCic a 1.01 was seen to be a major allergen in Indian chickpea allergic patients. Also, these allergens were seen to be major **cross reactive allergens** in pollen and peanut allergic patients.
- **Partial purification** of the natural Bet v 1 homolog from chickpea (nCic a 1.01) was performed. Validation of the recombinant allergens by inhibition immunoblot using raw chickpea extract and partially purified nCic a 1.01 from chickpea confirmed that Cic a 1.01 & Cic a 1.02 are present at the translational level in chickpea protein extract and recombinant allergens are able to mimic the allergenic response of their natural counterpart from chickpea.
- Allergenicity assessment of the soluble protein from the **traditionally processed** extracts and from the enzymatic hydrolysis of the raw and the processed extracts was analyzed. Soaking has shown decrease in allergenicity where as germination has shown increase in allergenicity

while in thermal processing all four have shown almost similar decreasing effect on allergenicity. Pepsin hydrolyzed extracts showed higher reduction of allergenicity as compared to trypsin hydrolyzed extracts.

- **Detection of chickpea allergens** in different model flour mixtures using Indian sera was performed. For the Indian sera limit of detection of chickpea allergens was found to be 1:1000 (chickpea flour: rice flour). However the method employing Indian sera was not able to discriminate between chickpea and peanut allergens.

Research Scholar: Shanooba P.M.
Research Supervisor: Prof. S. S. Lele

Studies on gourd family vegetables with special emphasis on bottle gourd, for theirbiotechnological applications

Cucurbitaceaefamily commonly called as gourd family shares 5 to 6% of this total vegetable produce in india that include bottle gourd, bitter gourd, ridged gourd, snake gourd, ash gourd and pumpkin. Many of these are earliest cultivated plants and are valued for their medicinal and nutritional benefits. Lagenariaspecies are of great importance as it is composed of all essential nutrients.

Initially study was conducted to understand the chemical composition and antioxidant activity of bottle gourd peel and edible part. Bottle gourd is rich in proteins and dietary fibers. Edible part contains significantly higher amount of total sugars compared to edible part. However, peel contains 474.53+4.5 mg GAE/100g of polyphenols whereas edible contains only 125.47+3.8 mg GAE/100g. flavonoid content of edible part and peel was 9.29 +0.12 and 14.27 +0.18 mg QEE/g respectively. The whole bottle gourd was found to be rich in essential amino acids too. To study the nutraceutical potential of bottle gourd, different parts of the plant were extracted via conventional solvent extraction and supercritical fluid extraction. The GCMS profile of the ethanolic extracts confirmed the presence of bioactivecompounds. The extracts were shown significant antioxidant, anti-inflammatory, anti-diabetic and anti-microbial activities. The results found were promising and showed the necessity of processing bottle gourd.

In the next part products and processes were developed using gourd fruit and peels. (i) minimal processing and hurdle technology concepts were applied and method of 1mM EDTA, 2.5% CaCl2, 2% sodium metabiosulphite(SMS) and 0.5% Citric acid followed by partial dehydration (30%)gave the best results. The pre-treated cut-fruit pieces were acceptable in quality during storage up to 20days at 40 C. (ii) functional beverages were developed by blending ash gourd and bottle gourd juices with jamun and Roselle juices. The optimized beverages showed excellent antioxidant and anti-inflammatory activity. Though the activities reduced during storage, all the products were microbiologically safe for the entire period. (iii) for waste utilization potential of bottle gourd peel for adsorption of chemical dyes was assessed. Reactive red 195-A (RRD) and reactive blue 222 (RBD) from aqueous solution were adsorped on dried chemically pre-treated bottle gourd peels. Batch adsorption experiments were conducted as function of contact time (0-250min), intial dye concentration (50-200mg/L), initial pH(2-10), sorbent dosage (0.2-1.0g/L) and temperature (303, 313 and 323K). the maximum adsorption capacities at 303K were found to be 245.5, 242.4 mg/g for RRD on to formaldehyde and acetic acid treated adsorbent with adsorption capacities 244.9, 245.8 mg/g at 303 K, respectively. The thermodynamic analysis provided insights to the endothermic and spontaneous nature of the adsorption process. The results indicated that bottle gourd peel could be used as an alternative to thecostly adsorbents used for dye removal.

Research Scholar:Chetan Arekar
Research Supervisor: Prof. S. S. Lele

Studies on Tropical Fruit Wines

Jamun and kokam are seasonal, coloured fruits which grow in Konkan region of Maharashtra. These fruits are rich sources of bioactives, but unfortunately,

they have remained largely underutilized. They are processed to only a small extent, that too in the production of low value products. In the present study, these fruits have been utilized for development of high value, exotic fruit wines with health benefits which will also help improve the economy of the Konkan region.

1. **Study of Indigenous Yeast:** Microflora was isolated from fruit rind and fermenting fruit. Based on the colony morphology observed on selective media, yeast colonies were selected. To identify capable strains for wine fermentation, the isolates were screened for their tolerance for alcohol and sugar. Selected yeast isolates were further studied for production of unwanted substances such as hydrogen sulphide, acetic acid, sulfur dioxide and biogenic amines. The screening methods, especially the tolerance study saved significant time and cost of analysis in selection of strains for wine fermentation study. The genus and species of the selected isolates were confirmed by biochemical and molecular identification. Isolate FJ10 and KF01 were identified as Saccharomyces cerevisiae. As isolate JR01 was identified as Candida tropicalis, it was excluded fromfurther study.
2. **Fermentation parameter optimization and Microvinification :** Indigenous yeast strains might have better fermentative as well as flavour (volatiles) producing properties as compared to other wine producing yeast. Thus indigenous as well as commercial strains were investigated for microvinification and wine volatile study.Isolate FJ10, KF01 and commercial yeast EC1118 were studied for winemaking. Fermentation parameters such as pH, temperature, inoculum size, requirement for di-ammonium phosphate, response to potassium metabisuifide etc were studied before actual lab scale fermentation (Microvinification). To understand the effect of yeast on winemaking, sensory evaluation and study of volatiles (Gas chromatography Mass spectroscopy) was conducted. Wine fermented with Commercial wine yeast was favoured by sensory panellist than indigenous one. Also Volatile study inferred that, commercial yeast has much better volatile profile especially fruity esters. Commercial wine yeast shows 77-79 % and 25 % fruity esters volatiles for Jamun and Kokum respectively. However, wine fermented by indigenous yeast shows less than 2% esters. Thus, commercial wine yeast EC1118 was selected for scale up study.
3. **Scale up of Jamun and Kokum Wines (100 L):** The microvinification process for Jamun and Kokum wine was scaled up to 100 L. Jamun Processed Fruit Wine (JPFW), Jamun Fresh Fruit Wine (JFFW) and Kokum-Banana Fruit Wine (KBFW) were studied for scale up. Fermentation parameters such as TSS after fermentation, residual sugar, pH, inoculum size, potassium metabisulfite for sterilization, percentage yield of wine with respect to fruit, alcohol to brix ratio etc. were studied during scale up. A detailed biochemical analysis of wines was carried out. JPFW and KBFW were immediately bottled after fermentation. JFFW was made to undergo ageing for three months. Change in colour of wine and autolysis/ apoptosis of yeast was studied during the period of aging.
4. **Biochemical and shelf life of wines:** Red wines have many bioactive compounds. One of the important classes of compounds is anthocyanin. High performance Thin Layer Chromatography, Uv-visible spectroscopy and Liquid chromatography - Mass spectroscopy were used to identify anthocyanins in jamun and kokum-banana wines. Jamun wine has Malvidine 3,5-diglucoside (80 %) as dominant anthocyanin out of 6 anthocyanins detected. Similarly Cyanidin (87 %) was dominant anthocyanin in Kokum wine out of 5 anthocyanin detected. Hydroxy citric acid, a compound known to aid

weight management was studied in kokum wine (3.8 g/l). Vitamin B complex and methanol content in wines were also estimated by gas chromatography. Various shelf life parameters were studied; the free sulfur content in wine bottle was a parameter which had direct correlation with shelf life.

5. **Sensory Evaluation of Wines:** Scale up of the winemaking process and biochemical analysis of jamun and kokum wine is only one aspect of the study. The other crucial aspect is the sensory appeal and aroma-flavour profile of wines. Panellists were classified as supertasters, average tasters and non-tasters based on fungiform papillae's present on their tongue. After a preliminary screening, an expert sensory panel was finalised, who assessed the fruit wines. Orthonasal and retronasal descriptors were studied. 12 orthonasal and retronasal descriptors were detected by panellist for KBFW. Similarly, for JFFW and JPFW 28 and 27 orthonasal and 23 and 25 retronasal descriptors were identified. Wines were compared with commercial grape wines as well as other available fruit wines. A correlation was made between sensory descriptors and actual volatile descriptors. A study of Jamun, Kokum-Banana juice was also carried out to identify volatiles responsible for a particular fruit aroma signature.
6. **Process flow sheet and Preliminary cost estimation:** A detailed flow sheet of the winemaking process for all three wines was made and the manufacturing cost of wines was calculated.

PH.D. (TECH) (BIOPROCESS TECHNOLOGY)

Research Scholar: Ashish Waghmare

Research supervisor: Dr. Shalini Arya

Bioprocessing and applications of valuable products from microalgae

The global population is estimated to grow rapidly by 47%, i.e. 8.9 billion in 2050. This may lead to severe food, feed and fuel crisis in coming years. According to the data of Food and Agriculture Organization of the United Nations (FAO) (2014-2016); about 795 million people in the world, or one in nine, are suffering from chronic undernourishment. Microalgae are an emerging, one of the most promising long-term, sustainable sources of biomass. These can grow on barren land in fresh and salt water and does not compete with other food sources.The main components from microalgae such as lipids, protein and carbohydrate can be used as source of feedstock for fuel, food, chemical, textile, polymer and pharmaceutical industry. Considering all above points present research was aimed with following objectives:

1. **Selection of microalgae strains:**
Chlorella pyrenoidosa,Scene desmusabundans, Spirulina sp., Dunaliellasalina, Nannochloropsisoculata and Euglena gracilis were collected from culture repository. Those strains were grown in reported growth medium and conditions. Biomass concentration, lipid content and total carotenoids were determined for all strains. Highest biomass concentration, lipid content and total carotenoids was found in Chlorella pyrenoidosa followed by that Dunaliellasalina.
2. **Optimization of cultivation conditions for microalgae**
Chlorella pyrenoidosa and Dunaliellasalinawere studied for cultivation condition. In case of Chlorella pyrenoidosa,various parameters were studied such as different growth medium, seed age, seed volume, batch time, pH, temperature, mixing, potassium nitrate concentration, carbon dioxide and light intensity for maximum biomass production. In case of Dunaliellasalina, various parameters were studied such as different growth medium, seed age, seed volume, batch time, pH, temperature, mixing, sodium chloride concentration, sodium nitrate concentration and light intensity for maximum biomass production.
3. **Selection of best method for harvesting of**

microalgae : Flocculation and bio-flocculation are most promising method of biomass concentration and were studied in the present work.

4. **Physicochemical characterization of selected microalgae biomass :** Biomass of Chlorella pyrenoidosa and Dunaliellasalinawere studied for proximate composition, amino acid profile, total carotenoid content (lutein and β-carotene concentration) and fatty acid profile.

5. **Effect of various methods on cell disruption and extraction**

a. **Ultra-sonication:** Maximum cell disruption (94.58 %) was obtained at solid load (1 % w/v), duty cycle (80 %), power output (54 watts) and time (90 min). Further, effect of pretreatment (NaOH, H2SO4, cellulose and autoclave) was studied.

b. **Hydrodynamic cavitation (HC):** Optimization of HC parameters for maximum cell disruption such as venturi or orifice device, pressure and solid load was studied. Further, effect of pretreatment (NaOH and H2SO4) was studied.

c. **Extraction of lipids:** Lipids from cell disrupted biomass was extracted using solvent (hexane and petroleum ether) and extraction efficiency was compared with Bligh and Dyer method. Further, fatty acid profile of different extracts were analyzed.

d. **Protein concentration by three phase partitioning (TPP):** TPP was used forconcentration ofproteins from Chlorella pyrenoidosa. Effect of various parameters of TPP was evaluated to optimize the concentration of proteins in middle layer. To maximize protein concentration, various parameters were optimized such as solvent (t-butanol), ammonium sulphate concentration (40 % w/v), solid load (0.75 g/20 mL), pH (6), incubation time (20 min), slurry to butanol ratio (1:1.5) and enzymatic treatment.Using these optimized parameters, 78.1 % w/w protein concentration was obtained in middle protein concentrate phase. This protein concentrate was characterized for proximate composition, colour analysis, water holding capacity, oil-holding capacity, foaming capacity, foam stability, amino acid composition, protein quality and thermal properties.

6. **Applications of valuable products**

Detailed food applications such as algal oil as deep frying oil and algal protein as emulsifier were carried out.

Research Student: Sandeep Choudhari

Research Supervisor: Prof. R.S. Singhal

Fermentative production, downstream processing and application of microbial cutinase

Cutinases (E.C. 3.1.1.74) are multifunctional serine esterases and are the smallest member of α/β-hydrolase fold family. It not only cleaves ester bonds in cutin but also in a variety of soluble and insoluble synthetic esters, triglycerides, plastics (polycaprolactone) and others. The flexibility of cutinase as lipase and esterase in its catalytic action makes it an attractive biocatalyst for several promising industrial applications like esterification, inter- and intra-transesterification reactions. These properties of cutinases are being explored for various applications in food and dairy, detergents, pharmaceuticals, biodiesel, agriculture, fine chemicals, and bioremediation and biodegradation.

Cutinase is induced only in presence of ω-free hydroxyl and mid-chain hydroxyl fatty acids. The major bottleneck in cutinase production is therefore the limited commercial availability of cutin which is solely available from few plants. This existing lacunae need to be addressed by exploring alternative sources of i) cutin, and ii) newer strains producing higher yields of cutinase in industrially viable and economically feasible conditions. The present work addresses major setbacks in cutinase production with the following work plan and objectives:

1. **Screening of cutin source:** Among the newer cutin source from the agro industrial wastes, cutin from peels of multi green colored

watermelon (WMC) yielded 6.77 U/ml vis-à-vis 9.64 U/ml of cutinase using apple cutin. The cutin so identified was characterized with respect to physico- chemical, morphological and thermal properties.

2. **Isolation and identification of novel strain:** Amongst the 50 cultures isolated from ruined fruits and vegetables, isolate from putrefied tomato showed better potential than the standard strain. The isolate was characterized morphologically and molecularly, and identified as a Fusarium sp. The 26S rDNA sequence (447 base pair) of the isolate was submitted to **Genbank under Accession no. KJ522754** and the strain have been deposited to **NCIM under accession no. Fusarium sp. ICT SAC1 NCIM 1384.**

3. **Submerged fermentation (SmF):** SmF for standard as well isolated strain using WMC cutin as a sole carbon source in shake flask was optimized with respect to culture conditions and media composition. Although the cutinase productivity was enhanced 3- fold, bioreactor studies with **Fusarium sp. ICT SAC1** were unsuccessful due to limited mass transfer and adherence of the substrate to the walls of the bioreactor.

4. **Solid state fermentation (SSF):** The potential of waste non-edible watermelon rinds (WMRs) as a low cost renewable solid substrate (inducer) for cutinase production was evaluated. The inherent reducing sugars in WMRs were found to be catabolite repressor of cutinase and hence water washing of WMRs was mandatory. The optimized conditions yielded 680.41 ± 46.39 U/gds of cutinase with a productivity of 7.09 U g of substrate-1 h-1 and a 20-fold improvement in cutinase titre. The production and fungal growth kinetics followed a simple logistic model.

5. **Downstream processing:** Several purification methods viz; TPP, activated carbon, aqueous organic two phase systems were attempted but were unsuccessful. Foam fractionation of cutinase yielded 3-fold purity with 95% recovery within 5 mins.

6. **Biochemical characterization:** Cutinase from SSF showed pH optima of 7-8, thermal stability up to 40 °C, better stability in non-polar solvents/metals/surfactants/chelators. Cutinolytic activity was confirmed by hydrolysis of apple and watermelon cutin, and characterization of the hydrolyzed monomers by GC-MS. The serine hydrolase nature of the enzyme was confirmed by its inhibition by specific serine inhibitors.

7. **Stabilization of cutinase:** Stable cutinase biocatalyst was prepared by carrier free cross-linked enzyme aggregates (CLEA) and immobilization in mesoporous silica's. Simultaneous concentration, purification of cutinase directly from SSF fermented broth was successfully achieved in CLEA. It was found that 50% (w/v) of ammonium sulfate, 125 µmol of glutaraldehyde, cross-linking for 1 h at 30 °C and broth pH of 7.0, yielded 58.12% activity recovery. The CLEA so developed showed better thermal, solvent, detergent and storage stability thus making it more elegant and efficient for several industrial biocatalytic processes. Two different MPs, viz. MCF and SBA-15 were synthesized for cutinase immobilization. Immobilization was performed by simple adsorption and cross-linking. Routine analysis of immobilized biocatalyst confirms the loading of the protein.

8. **Kinetic resolution:** Cutinase was explored as a potential biocatalyst for its regio and enantio selectivity towards (R,S)-1-phenylethanol as a model substrate and showed its catalytic action towards the R isomer. The optimized reaction conditions such as agitation speed of 150 rpm at 35 °C using 9 mM vinyl acetate with enzyme loading of 200 mg/10 ml reaction mixture in n-hexane yielded an enantiomeric excess of the (R)-1-phenylethylacetate with 39.7% conversion, E of > 99% and ees of 65.1%. Further process

intensification using microwave irradiation was also successful.

Research Scholar:Chetan Joshi

Research Supervisor: Prof. R.S. Singhal

Fermentative production and downstream processing of zeaxanthin

Zeaxanthin is an orange-red coloured, lipid-soluble xanthophyll occurring naturally in corn, marigold flowers and in various fruits and vegetables. It has diverse applications in pharmaceuticals because of its preventive effect against diseases like cancer, age-related macular degeneration, cataract and atherosclerosis. It is also used as a feed supplement in poultry and aquaculture to enhance the colour of yolk and flesh. These diverse properties of zeaxanthin make it an industrially important metabolite. Commercially, it is produced either by conventional hexane based extraction of red marigold flowers or by chemical synthesis using Wittig's reaction. Conventional extraction gives poor extraction yields, while chemically synthesized zeaxanthin is not readily accepted by the consumers due to their preference for natural products. With this background, the project was undertaken with the following objectives:

1. **Screening of microbial sources and production medium:** Standard bacterial strains from different culture collections were procured and screened for their potential to produce zeaxanthin, among which Paracoccus zeaxanthinfaciens ATCC 21588 was selected and further explored as a potential zeaxanthin producer using different fermentation medium reported in literature.
2. **Optimization using mathematical tools:** Various nutritional and environmental factors affecting zeaxanthin production were optimized using traditional one-variable-at-a-time (OVAT) approach followed by ANN-GA and RSM-GA. This sequential approach increased the zeaxanthin production from 4.44 mg/L to 11.63 mg/L. ANN-GA prediction (11.81 mg/L) was better than RSM-GA (11.76 mg/L) with lower percentage error (1.55).
3. **Bioreactor studies:** Bioreactor studies using stirred tank reactor and bubble column reactor were undertaken with an aim to increase the production of zeaxanthin using the medium optimized by ANN-GA as above. An air flow rate of 0.75 vvm and dissolved oxygen saturation on 75% in the stirred tank reactor increased the production marginally to 13.21 mg/L. In bubble column reactor, ANN- GA based optimization predicted a maximum zeaxanthin production of 14.79 mg/L at 3.507 vvm, 4 % inoculum size and 55.83 h against the experimental production of 15.29 ± 0.51 mg/L. Different industrial byproducts such as corn steep liquor, molasses and glycerol were then screened for zeaxanthin production under the conditions optimized by ANN-GA.
4. **Recovery and purification of zeaxanthin:** Recovery was done using UA-TPP. An ammonium sulphate concentration of 30%, biomass slurry: t-butanol ratio of 0.5, an incubation temperature of 50oC, and incubation time of 30 min provided optimum recovery. The process was then scaled-up to 1L in a stirred tank vessel. Purification of zeaxanthin from the crude t-butanol extract was done using silica gel chromatography which gave a recovery of 74%. The eluted fractions were analyzed by HPLC and were later characterized by FTIR and MS analysis. Purified zeaxanthin was further analyzed for its antioxidant ability and temperature stability.
5. **Application of zeaxanthin in the production of 'designer eggs':** Since Paracoccus zeaxanthinfaciens ATCC 21588 has a GRAS status, the dried biomass was feed to broiler hens for a month at 1 g and 2 g/100 g of poultry

feed. The eggs collected after one month showed about ~ 4.5 fold increase in the zeaxanthin content of the eggs so obtained.

PH.D. (SCI) (BIOTECHNOLOGY)

Research Scholar: Suprama Datta

Research Supervisor: Prof. U. S. Annapure

Profiling and exploitation of Saccharomyces cerevisiae var. boulardii for production of bioactive molecules

Saccharomyces cerevisiae var. boulardii (Sb) is the only yeast species with probiotic properties. It has been used as an adjunctive therapy for treatment of infectious gastroenteritis or in the prevention and cure of antibiotic associated diarrhea (AAD). However, the taxonomic characterization of S. cerevisiae var. boulardii has been controversial. Furthermore, Sb has been explored for its modus operandi for therapeutic use but not much research has been channeled into exploring the presence of biomolecules such as metabolites or polypeptides from this yeast and possibility of their potential industrial applications. Therefore this study presents a new perspective of differentiating the two genetically related strains of yeast, Saccharomyces cerevisiae and Saccharomyces cerevisiae var. boulardii. The findings from this stage of the work were further explored to unravel the mechanisms of production of industrially relevant bioactive molecules in the yeast. Following is the overall summary of the work:

- Growth kinetic parameters of Saccharomyces cerevisiae var. boulardii (Sb) were assessed and compared with that of Saccharomyces cerevisiae (Sc). Both the yeast strains showed no significant difference in growth rates under normal laboratory and simulated in-vivo conditions. Although the maximum cell biomass were significantly different between the strains under both conditions. The optimum doubling time (td) was measured at the period of maximum growth rate (μ). This study rendered a comparative outlook for the growth pattern under normal and in vivo conditions, addressed the phenotypic difference between both the strains and most importantly aided in determining the sampling time points for later part of study.
- The probiotic attributes of Saccharomyces cerevisiae var. boulardii (Sb) were studiedby stress-tolerance assays. Significant difference ($p<0.05$) in cell viability (%) between Sb and Sc for 37 °C, 39 °C and simulated gastric condition were observed. At 45 °C and simulated intestinal condition, both the strains showed comparable cell viability. Sb shows tolerance upto 1% w/v bile salt concentration which substantiates the robust probiotic behavior of this yeat as published literature suggests 0.3% as the minimum concentration to define an organism as a probiotic resistant to bile salts (Gilliland SE et al, 1984). Overall higher stress tolerance of Sb suggests promising probiotic attribute. As Sb is still in a controversial hierarchy, this enabled the comparison of another aspect of phenotypic characterisation of both strains.
- The antioxidant potential of Saccharomyces cerevisiae var. boulardii (Sb) was evaluated for both cell-free extract (CFE) and solvent extracted fractions (EAF) of both the strains. The total phenolic content (TPC) and total flavonoid content of Sb was found to be ~70 fold and ~ 20 fold higher than that of Sc respectively. Percentage inhibition of the DPPH• radical was in the order of BHT (control) > CFE Sb> EAF Sb> CFE Sc> EAF Sc. No significant difference between the activities of the cell free extract and solvent extracts of S. cerevisiae var boulardii was observed in this study.
- A global metabolite fingerprint was developed using Gas chromatography (GC) coupled with Mass-spectrometry (MS). Statistical data analysis suggested the two strains of Sb and Sc are markedly different with respect to stress-tolerance (probiotic) and antioxidant properties. Hence a global metabolite

profile was developed in order to identify therapeutically important metabolites using a semi-qualitative analysis by GC-MS and a comparison was also drawn to scope the metabolome of the two strains. The extracellular fraction of the Sb cultures was found to be rich in polyphenolic metabolites which results in the antioxidant capacity of this strain. Many of the extruded metabolites were found to be phenolic aldehydes and their acid counterparts.

- Candidate gene identification in putative over production pathways for phenolic metabolites was conducted by in-silico analysis of the genome sequence of Sb. The genes encoding regulatory enzymes for the phenylpropanoid pathway were considered as candidate genes for initial study. Upon scrutiny, the pathway enzymes were not found as this pathway is not inherent of yeast. Therefore, this observation directed the impetus to investigate the Stress Responsive Elements (STRE) which has plausible reason to be responsible in production of bioactive metabolites. Aldehyde dehydrogenase (ALDH) superfamily, being one of the STRE group members (Singh et al, 2013), was further exploited for their putative specificity towards the detected metabolites.
- Cloning, expression, purification and characterisation of ALDHs from S. cerevisiae var. boulardiiTwo members of the yeast aldehyde dehydrogenase superfamily, mitochondrial Ald4p, cytosolic Ald6p were cloned from Sb, recombinantly expressed, purified and characterized. A hypothesis to explain the different substrate specificities was advanced based on the molecular models of the proteins generated and verified experimentally. Both Ald4p and Ald6p were oligomeric in solution and demonstrated positive kinetic cooperativity towards aldehyde substrates. Wild-type Ald6p showed activity only with aliphatic aldehydes, whereas Ald4p showed activity with benzaldehyde and a limited range of aliphatic aldehydes. Ald6p in-silico model suggests steric hindrance due to bulky amino acid residue in the active site (Met-177). A variant of Ald6p with the valine at position 177 showed an increased specificity range and gained activity towards cyclic substrates.

Research Scholar: Jayashree Hariharasubramanian

Research Supervisor: Prof. R. S. Singhal

Fermentative production and downstream processing of fucoxanthin

Fucoxanthin (Fx), a C40-xanthophyll carotenoid found abundantly in brown algae has possible applications in functional foods due to its preventive and therapeutic effect on obesity, diabetes and related biological activities thereof, as established using laboratory studies & animal research. Our study aimed at identifying alternate sources of fucoxanthin by identifying suitable alternatives, improving its production, downstream processing, and evaluation of its efficacy & suitability in wide-ranging application studies.

Analytical protocol: Analytical protocol was standardized after a thorough examination of various techniques post cell lysis among which isocratic HPLC was selected for analysis of Fx from microbes & brown algae. Mechanical grinding for 10 min showed maximal release of fucoxanthin from intact cells. Among the microbial strains, Rhodotorula glutinis NRRL YB 252 gave relatively good fucoxanthin yields while producing co-metabolites, viz., exopolysaccharides (PS) & enzymes [Phenylalanine Ammonia Lyase (PAL), α-Arabinofuranosidase (AAF) and first-ever report of extracellular deoxyribonuclease (eDNase)]. Stable mutants of this strain was created until ten generations for identifying Fx and PS hyper producers.

Production: Production medium of all the five metabolites as listed above was optimized by one factor at a time (OFAT) followed by Placket-Burman and RSM-CCD. Some agro-wastes were also evaluated

in these trials. The optimized medium was used for bioreactor trials in stirred tank (ST) and bubble column (BC) reactors to study the effect of various aeration and agitation speeds on Fx and PS production. 1 vvm @ 250 rpm & 2.5 vvm @ 250 rpm were selected for ST& BC, respectively, while, pH control study did not benefit Fx and PS production. Optimized BCR conditions were used to study enzyme production profile in normal and immobilized systems. Selected mutant generations were studied in optimized BCR conditions to assess metabolite(s) production levels.

Downstream processing: Fx was successfully extracted from Sargassum muticum&R. glutinis NRRL YB 252 using optimized ultrasonic assisted extraction (UAE) and microwave-assisted extraction (MAE). Simultaneous extraction of Fx& PS using three phase partitioning (TPP) as well as UAE-TPP & MAE- TPP from brown algae was undertaken. Fx was purified using silica gel column chromatography using Hexane: Acetone (70:30) and the purified Fx were characterized. PS was purified using 50-460 mm DEAE Sepharose packed column and purity assessed using AGE. The Fx stability was assessed under different stress and storage conditions. The stability of Fx was enhanced on addition of 1% BHT & 0.5% ascorbic acid.PAL AAF & eDNase was purified using dialysis, (NH4) 2SO4 precipitation & TPP.

Green biosynthesis of nanoparticles: After identifying the ability of R. glutinis NRRL YB252 to synthesize silver and gold nanoparticles, effects of various factors and conditions on their synthesis were studied, purified using density gradient centrifugation using Ficoll 20-400%. Ecotoxicity of synthesized silver and gold nanoparticles was assessed using Daphnia magna.

Product-based applications: Fx was evaluated for its potential use in cosmetics and for treatment of Parkinson's. PS was evaluated as a cryoprotectant for selected bacterial and yeast test cultures. Silver nanoparticles showed improved anti-microbial efficacy against the test cultures.

In vitro toxicity testing & application studies: Post in vitro toxicity (cyto & geno) evaluation of Fx, PS, and silver and gold nanoparticles, their potential for fibrinolytic activity and therapeutic activities were examined and very promising results were noted. Although PS did not show film-forming properties, it did demonstrate good gelling and emulsifying properties. In vivo evaluation of Fx as an anti-obesity agent was examined using C. elegans as a model living system.

PH.D. (SCI) (BIOCHEMISTRY)

Research Scholar: Mugdha Dabir

Research Supervisor: Dr. Laxmi Ananthanarayan

Studies on characterization and deactivation of fruit based enzymes

India has a plethora of fruit bearing species many of which still remain unexplored due to seasonal nature and lack of proper processing strategies. Conventional methods of food processing such as thermal which involve direct heat, although feasible in terms of easy process operation and easy scale up, most often lead to loss of color, flavor as well as essential nutrients. Emerging techniques of food processing may be able to sustain and overcome the damaging effects of conventional methods. Hence present work was undertaken to study selected enzymes of bael (Aegle marmelos) and custard apple (Annona squamosa) fruits and effect of ultrasonication on their activity.

- **Partial purification of quality hampering enzymes** peroxidase (POD) and pectin methylesterase (PME) from bael and custard applehas been performed using ammonium sulphate precipitation and ion exchange chromatography. POD was partially purified with 53.2 and 62.0 fold purity from custard apple and bael, respectively. Partial purification of PME was achieved with fold purity of 6.24 and 67.41 from custard apple and bael, respectively. The molecular weight was estimated and found to be 14.4 and 45 kDa for custard apple and bael POD; 62 and 23 kDa for custard apple and bael PME. Kinetic constant for bael and custard apple POD were 0.090 mM and 0.76 mM, respectively; 0.692

mg/mL and 0.313 mg/mL for custard apple and bael PME, respectively.

- **Inactivation of POD and PME from bael and custard apple** has been performed using thermal processing and ultrasonication. Both enzymes followed first order kinetics. While thermal processing took 22 min for custard apple and 11 min for bael, ultrasonication achieved the complete enzyme inactivation within 5 min for custard apple and 4 min for bael. Inactivation of PME in both fruit sources has been achieved within seconds by ultrasonication as compared to thermal processing.
- **Thermosonication of custard apple and bael juice** led to irreversible inactivation of POD and PME with retention of essential bioactive components such as marmelosin in bael juice and vitamin C in custard apple juice with minimal effect on physical parameters. Custard apple juice which is heat sensitive was thermosonicated at 30 °C for 40 min which led to complete peroxidase inactivation with minimum impact on pH, Brix and colour values. Bael juice was thermosonicated at 30, 50 and 70 °C requiring 35, 22 and 17 min for complete peroxidase inactivation with improved juice quality in terms of total phenolics content and cloud value. Storage studies for thermosonicated bael and custard apple juice has been performed for three months at refrigerated storage.
- **Methylene blue (MB) dye decolorization was studied using custard apple peel powder.** Langmuir Type II adsorption isotherm (R2 = 0.9981) which denotes uniform dye adsorption as a monolayer provided better fit of MB on custard apple peel than other isotherms studied. The maximum adsorption capacity (qm) calculated was 71.42 mg/g and pseudo second order kinetics worked best for methylene blue dye decolorization using custard apple peel powder.

Research Scholar: Chandrahas R. Vishwasrao

Research Supervisor: Dr. Laxmi Ananthanarayan

Biochemical Characterization of Indigenous Fruit Varieties during Ripening and Extended Shelf Life

Tropical climate of India favours growth of many seasonal fruits with good nutritional qualities and with limited shelf life of which many are still underutilized. Fruits such as guava (Psidium guajava) and sapota (Manilkara zapota)make a major share of export from India. Very limited information is available about leading variety of guava (Lalit) and sapota (Kalipatti). Both the fruits are of immense importancein view of fruit processing as it is used for production of jam, jellies, juices, squash etc.

1. **Ripening studies:** Initial research dealt with understanding the process of ripening for indigenous fruit varieties of guava (Lalit) and sapota (Kalipatti). Both fruits were studied thoroughly for physical, chemical and biochemical changes. Physiological weight loss (~ 25& 35%) along with loss of flesh firmness (~ 92& 75%) were the major concern observed for Kalipatti sapota and Lalit guava during storage. Skin and flesh darkening, decrease in phenolic content and increase in total reducing sugar was observed in both the fruits during ripening.Also biochemical changes related to enzymes such as peroxidase (POD), polyphenol oxidase (PPO), ascorbate oxidase (AO) and pectin methyl esterase (PME) has been studied. POD and PPO activities observed during early stages of ripening resulted in quality loss. PME was found to have a positive correlation with fruit softening. Data obtained from maturity study of sapota was used to develop a model based on artificial neural networks. Model could predict ripening stage of sapota fruit as ripening index and could even detect over ripe stage of fruit.
2. **Edible coating:** Edible coating for increased shelf life of fresh produce is a viable technique. Based on preliminary studies

conducted, methyl cellulose (MC) and hydroxypropyl methyl cellulose (HPMC) were selected to coat sapota and guava fruits respectively. To improve the water barrier properties of the coatings, palm oil (PO)was incorporated, making it a composite emulsion coating. Shelf life of sapota fruit was increased by 75% by using MC-PO coating on Kalipatti sapota fruits.HPMC (1%)-PO coating worked best for Lalit guava fruits giving 12 days of shelf life as compared to 8 days for uncoated fruits. Edible coatings preserved the fruit appearance and nutritional qualities for longer period of time as compared to uncoated fruits.

3. **Enzyme purification and characterization:** Enzymes namely, POD, PPO & PME were isolated from sapota fruit pulp. These enzymes were purified using anion exchange chromatography and size exclusion chromatography so as to obtain a single band with SDS-PAGE. Fold purity obtained for sapota POD, PPO and PME was 10, 7 & 8, respectively. Partially purified enzyme had there optimum activity at temperature of 65, 45 and 35 °C.Guava POD, PPO, AO & PME were also purified using chromatographic techniques to a fold purity of 28, 30, 36 & 30folds, respectively. Further, partially purified enzyme fractions were used to determine the molecular weightof the enzymes. Enzyme characteristics such as pH, temperature and substrate dependencies were then studied. Guava PME was found to be stable till 65 °C whereas, POD, PPO and AO was inactivated beyond 35 °C.
4. **Heat inactivation studies:** Thermal processing is the most common method of enzyme and microbial inactivation used in the food industry.It is extensively studied and cost effective. Kinetics involved in thermal inactivation of indigenous quality deteriorating enzymes such as POD, PPO and PME was studied in the guava pulp and crude enzyme extract. In sapota fruit, POD was found to be the most heat resistant enzyme (z-value = 17.6 °C) and can be used as potential indicator of efficacy of thermal processing.In guava pulp thermal inactivation kinetics of enzymes such as POD, PPO, AO and PME was studied along with deactivation kinetics of phytoconstituents such as ascorbic acid and lycopene. Guava PME (z-value = 39.4 °C) was least affected by thermal processing. AO (z-value = 14.3 °C) was the most heat labile constituent amongst studied components of Lalit guava. Lycopene (z-value = 41.7 °C) from guava pulp showed better stability against thermal processing as compared to the enzymes studied. In both the fruits, the more heat stable enzymes exhibited a higher z-value than that of the potential contaminating microorganisms, which leads one to conclude that enzyme inactivation needs to be considered as well for increasing shelf life of fruit pulps.
5. **Green synthesis of Ag nanoparticles:** Waste generated after processing of fruits at a commercial scale is a bio-burden to be tackle.Sapota pomace was used for synthesizing of silver nanoparticles (AgNPs) by a green biosynthesis approach. AgNPs formed were of average size 324 nm with polydispersity index of-0.663 and showed a ζ potential -12 mV. Further AgNPs were characterized by FTIR, XRD, SEM and TEM. Antimicrobial properties of AgNPs were explored using agar diffusion method.

M. TECH. (FOOD ENGINEERING & TECHNOLOGY)

Research Scholar: Rahel Das
Research Supervisor: Prof. R. S. Singhal

Studies on protein co-precipitates

Co-precipitation of proteins involves extraction of crude protein from two sources and their precipitation together to a common protein mixture. Protein co-precipitates are reported to show better nutritional quality and functional properties. The lysine-deficient cereals and methionine-deficient legumes are complimentary in such co-

precipitates. Corn (Zea mays) and red kidney bean (Phaseolus vulgaris) were selected as the cereal and legume combination in this work. Use of corn meal after corn germ oil extraction will aid in by-product utilisation. Besides, corn (C) is a gluten free cereal. Red kidney bean (RKB) is one of the richest protein containing bean. The debate of food vs. fuel can be averted by preparing co-precipitates so that the starchy matrix could be utilized for the production of bioethanol and the resultant co-precipitate as a protein source.

The optimized conditions for production of C-RKB protein co-precipitate, were dilution ratio of 1:15 of the cereal and legume flours with distilled water, adjustment to pH 9, extraction for 60 min and isoelectric precipitation at pH 4.5. Addition of 1% (w/w) salt to the flour and 1% (v/v) amylase to the flour and solvent mixture prior to extraction gave higher yields. Maximum protein content and protein recovery obtained was 95% and 91.34% for C-RKB co-precipitates, respectively. The content of anti-nutritional factors, viz. tannins, trypsin inhibitor content and phytic acid content, were reduced by 50% or more in the C-RKB co-precipitate when compared to their contents in the respective flours, while that of the calcium and iron increased substantially. In vitro protein digestibility was higher in the C-RKB precipitates. Thermal studies revealed the denaturation temperature and FTIR the secondary structure, while SDS PAGE showed the polypeptides present in the isolated and co-precipitated protein. SEM exhibited their surface morphology. Particle size and crystallinity were also determined.Overall, the C-RKB protein co-precipitates showed improved physico-chemical and nutritional properties. C-RKB protein co-precipitate exhibited superior values for water absorption capacity and emulsification properties, but poor values for gelation. The chikki type protein bar developed on incorporation of 8% C-RKB protein co-precipitate had around 18.68% protein content per bar (~ 68g) and was acceptable in terms of organoleptic properties and can be a viable product to combat protein deficiency.

Research Student: Sidhant Banura
Research Supervisor: Prof. U.S. Annapure

Effect of cold plasma treatment on properties of starches

Starch is a biopolymer composed of glucose units and is the major storage energy in various plants in nature. It is made up of two major polymers: amylose and amylopectin. Native starches are not suitable for use in food industry due to their hygroscopic nature and other related properties. Thus, structural modifications are required to achieve the desirable properties for industrial applications. This is done by either chemical or physical modification. Physical modifications are preferred due to simpler, safer and low cost processes and no left over of after treatment chemical residues. Cold Plasma processing is one of the recent developments in physical modifications. Plasma is referred to as the fourth state of matter, next to solids, liquids, and gases. Corn, potato and tapioca starch were modified using cold plasma treatment with different time-power combinations. The studies were done for physicochemical, rheological and thermal properties. The peak viscosity, final viscosity, water absorption capacity, and swelling power increased for all the samples. The results showed that there was significant difference in the storage and loss modulus after treatment. The structural changes were observed which was confirmed by FTIR, SEM and XRD. The thermal properties showed the decrease in gelatinization temperature and enthalpy which can be attributed to the structural breakdown due to physical modification. There have been variations on the impact of cold plasma treatment on corn, potato and tapioca starches that can be attributed to the biological difference of starch source. The plasma treatment can be used effectively to modify the physico-chemical properties of starches and is a safe physical method of starch modification.

Research Student: Yuga Bhat
Research Supervisor: Prof. S. S. Lele

Product & process development for utilization of Dill Herba(Anethum graveolens) and Drumstick Pods (Moringa Oleifera)

In tropical developing contries like india the fruit and vegetables sector has a vital role in farm income enhancement, food security and sustainable agriculture.

Dill (Anethum graveolens) locally known as shepu or savaa, has a unique intense flavor which is found to make its preparations sometimes unacceptable among consumes. This has restricted the availability of a commericial food product made from dill attempts were made in the present study to balance this intense flavor with moong dal and develop dill based products with good color retention . retort processing and convective drying were employed in developing products: retorted Dill curry (RDC) and Dill soup premix (DSP).

RDC showed stability in terms of microbial sterility, FFA (< 0.4% oleic acid). PV (< 12 meg of 02/ kg fat). TBA value (< 0.07Abs). texture and physic-chemical profile and sensory analyses over a period of six months of ambient storage. There was a reduction in DPPH radical scavenging ability of DSP from 32.21+ 1.28% to 19.60+0.64%. over the period of 2 months of accelerated storage at 550C both products were good sources of fiber, protein, vitamin C and minerals and had a low GI . on the basis of in-vitro protein digestability and reduction in antinutrients (phytates, trypsin inhibitors, tannins), RDC was better cooked compared to traditional open pan cooked curry on estimating a potential for commercialization, it is found that about 30kg dill sourced from farmlands can give us about 100kg RDC when combined with 1.05kg dal and other ingredients whereas about 22kg fresh dill gives around 1.4 kg dill leaf powder which gives 10kg of dry DSP.

The pods of Moringa Oleifera are nutritious and particularly rich in proteins, minerals and vitamins and have excellent therapeutic advantages. Attempts to thermally process the pods in retort pouches have resulted in longitudinal splitting of pods effects of partial dehydration of pods upto 50% weight reduction before retort processing were studied partial dehydration minimized the detrimental effects of stream flashing of inter and intra cellular water and helped strengthen the tissue structure of pods. However longitudinal rupture of pods was found to occur mainly due to sudden expansion of steam due to pressure drop during cooling cycle of retorting. Hence, slow sequential cooling could be the best solution.

Research Student: Ashwini Mohurle
Research Supervisor: Prof. R.S. Singhal

Study of Functional Properties of Protein Co-precipitate

Consumption of cereals and legumes is decreasing day by day due to modernization of lifestyle. Therefore, a way to reuse these commodities is needed due to high protein content of legumes and complementary advantage of cereal and legume together. Protein co-precipitate can be a way to fulfill this demand. Also, protein energy malnutrition is a serious problem for people whose diet depends mainly on starch source. Therefore, an effort is made through this study to produce the protein supplement for such people. The aim of the study was preparation and optimization of process parameters for the production of protein co-precipitate. The results showed that a protein co-precipitate can be prepared by blending defatted jowar flour and defatted moth bean flour by using optimized parameters for process. The optimized parameters were mixing of defatted powder, addition of salt, addition enzyme, solute to solvent ratio 1:15, extraction pH 9, extraction time 60 minute, precipitation pH 4.5, heating after precipitation and heating temperature at 75°C. The protein co-precipitate contains lower amount of anti-nutrients, non-protein nitrogen and polyphenols and increased in vitro protein digestibility and higher mineral content. Color of the protein co-precipitate is darker. All protein bands □-sheet, □-turn and □-helix structures are observed in the protein co-precipitate. Thermal denaturation temperature of protein co-precipitate is observed at 80°C. Scanning electron microscopy shows different structure of protein bodies. Protein co-precipitate prepared has higher bulk density, good water absorption capacity, fat absorption capacity. It shows solubility profile similar to other protein isolates. Emulsifying and

foaming properties of protein co-precipitate are satisfactory but poor gelling property. Due to high protein content it can be used in different food products. Protein content of the food product can be increased by fortifying it with protein co-precipitate.

Research Student: Sunil Jondhale
Research Supervisor: Prof. U.S. Annapure

Studies in isolation and characterization of plant gum exudates

Plant gum exudates are important polysaccharides with wide range of applications in food as well as other industries. This study deals with the isolation purification and characterization of gums from three plants, Anogeissuslatifolia (DG), Lanneacoromandelica (MG) and Moringaoleifera (SG). Gums were collected from respective plants, washed, cleaned, dried, crushed and stored in air tight bottles. Purification was done by using alcohol precipitation. Purified gums further undergone with proximate analysis. Physicochemical properties such as shape, colour, bulk and tapped density, Hausners index, compressibility index, x-ray diffraction (XRD), scanning electron microscopy (SEM), pH, sugar profiling using HPLC, uronic acid and reducing sugar and functional properties such as water holding capacity, oil holding capacity, foaming capacity, emulsion capacity and rheological properties were studied. Thermal properties were studied by differential scanning calorimetry (DSC).

Results showed that DG contains good amount of protein that is 4.32%. DG gum found to have arabinose, galactose and uronic acid in the quantity of 34.17, 30.85 and 14.83 respectively. MG gum found to have arabinose, galactose and uronic acid in the quantity of 15.29, 47.41 and 17.2% respectively. And SG found to have arabinose, galactose and uronic acid in the quantity of 35.95, 32.46, 15.12 %. Emulsion capacity of DG, MG and SG was 80-83, 66-69 and 70-73% respectively. Rheological studies revealed that SG gum has high viscosity than the DG and MG even at low concentration. XRD shows that all three gums have crystalline and amorphous nature. SEM shows that shape of all gums is irregular and fragmented. Bulk and tapped density, compressibility index, angle of repose revealed that DG has great flow property. Compressibility index for SG was too high that is 39.49 reveals that gum is suitable for packing but don't have good flow properties. From the research it is concluded that these all gums have good properties and can be effectively used in food industry.

Research Student: Dhananjay Ghorpade
Research Supervisor: Dr. S.S. Arya

Studies on peanut meal incorporated bread

Bread in its many forms is one of the most staple foods consumed by humanity and is a part of a healthy eating pattern as it is low in fat. It is made up of energy providing carbohydrates, proteins, vitamins and minerals. Peanut is the major oil seed crop in India and plays a major role in bridging the vegetable oil deficit in the country. Peanut is also a good source of antioxidant, such as p-coumaric acid, contributing factors to potential health benefits of their consumption. Peanut meal is a by-product obtained after extraction of oil. Bread is an ideal food for protein fortification since it is a major staple throughout the world, and peanuts can serve as a source of protein for fortification because peanut is good and readily available source of protein. Fortifying bread with legume or oilseed proteins is one of the primary methods available for raising protein levels in human diets for economic and/or health reasons.Optimization of ingredient was carried out by one factor at a time method on basis of sensory acceptance and dough characteristics by varying their proportions. The optimized composition of bread was: water (86% w/w), sugar (12% w/w), shortening (3% w/w), yeast(3% w/w) and salt (1.5% w/w) was added in whole wheat flour (100 g) to form dough. Peanut meal level to replace wheat flour was varied as 5%, 10%, 15%, 20%, 25%, 30%, and 35%. The effect of addition of different proportions of peanut meal on dough characteristics (stickiness) and on bread quality (color, texture, proximate and sensory) was evaluated. On the basis of all these analysis; 20% level of peanut meal was

optimized to replace wheat flour to make peanut meal bread. The nutritional aspects of peanut meal are found more beneficial than control bread. Glycemic index was found decreased in optimized peanut meal bread than control bread. Protein digestibility & antioxidant capacity was also increased for optimized bread. The peanut meal bread and control bread samples were stored at 30±2 oC& 04±2 oC for staling studies. The result showed that the moisture content of bread was decreased at both temperatures. Sensory attributes were decreased as storage period increased whereas firmness of peanut meal bread & control bread was increased significantly during storage period. WSS & IVSD was found to be decreased during storage period at both temperatures. Therefore the peanut meal can be used as a useful fortificant in bread to increase its nutritional values especially protein & also to make the product functional with respect to health aspects.

Research Student: Jain Rahul

Research Supervisor: Prof. S. S. Lele

Studies on microwave processing of paneer and wheat grass dehydration

Part A: Microwave processing of paneer

Paneer-cuisines have always been a symbol of royalty on dining table of Indian households.Generally, it is added in the last while preparing any dish. Otherwise, the texture of the added paneer will become too soft and the structure disintegrates. Therefore, a minimal processing is required for the fast moving consumer's lifestyle which can improve the texture properties of food. Microwave (MW) processing could be thought of as a good option for this. As the kinetics of texture degradation of paneer cubes (1x1x1 cm3) obtained at 60-100 ˚C of warm water for 30 s, 60 s, 2 min, 5 min, 10 min represents the decrease in hardness of paneer. MW Power levels: 60-100% of 800W with equidistant interval of 10% and treatment time: 20 to 120 s with a equidistant time interval of 20 s was taken as the independent parameters. MW processing at 80% power level of 800 W for 74 s was found to be an optimum condition. MW processing of paneer at its optimized condition increases hardness and percentage of moisture loss. Therefore, on addition of microwave processed paneer to any cuisine will give a good textured paneer with good taste and flavor.

Part B: Studies on wheat grass dehydration

In the developing countries, many low-income families rely for their nutrition on staple food crops such as wheat and rice that are poor sources of various nutrients and minerals. To provide a wholesome nutrition for a healthy and rejuvenating body, green foods could be very useful in providing nutrients like vitamin, proteins, minerals, fibers, flavonoids and antioxidants which are researched for numerous health benefits. Wheat grass (WG) is such a kind of source but its cropping in unhygienic conditions, harvesting and perishability prevents it to get a place on market shelf. WG juice is very perishable and shows phase separation. So, WG dehydration was thought of as a good source of nutrition. Tray dried and spray dried WG powders were prepared and compared on the quantity of bio-active compounds – chlorophyll, TAA, TF, TPC; flow properties – CI, BD etc. of it. Spray drying of wheat grass juice was challenged by clogging of nozzle, which was solved by altering its pH.

Research Student: Himanshu Chaudhary
Research Supervisor: Dr. Laxmi Ananthnarayan

Enzyme active grain flours in novel food applications

Cereals and legumes are important sources of energy, carbohydrates and proteins and are considered as staple foods. However their anti-nutritional factors limit their nutritional quality and applications in foods. Germination helps in activation of enzymes like amylase, protease, which break down starch and protein respectively and enhances their nutritive value. It induces the formation of enzyme that reduce the inherent anti-nutritional factors in grains. Since germinated cereals have high nutritive value and improved digestibility, they can be incorporated in health food preparations.

The effect of germination on enzyme activity (amylase, protease and phytase activity) in wheat, sorghum and green

gram was studied. Enzyme activity increased up to 3 days of germination in wheat and sorghum and up to 2 days of germination in green gram. The functional properties such as bulk density, water and oil absorption. Emulsification capacity of grain flours (wheat, sorghum and green gram) improved on germination. The germinated flours were mixed with wheat flour at varying proportions, resulting in improved % reduction in phytic acid content standerisation and optimization of chapatti incorporated with germinated wheat flour and bread incorporated with sorghum and green gram was undertaken. The nutritional and textural properties of the optimized products were anaylsed. Incorporation of germinated wheat flour in varying proportions reduced phytic acid content of chapatti dough by 21.35-30.42%. the effect of germinated flour on sensory acceptability of chapatti and bread was studied; chapatti containing 15% germinated wheat flour and bread incorporated with 15% germinated wheat flour and bread incorporated with 5% germinated sorghum and 10% germinated green gram flour were found to be acceptable organoleptically. Further, stalling studies for chapatti and bread over a period of 6 days suggested that chapatti with germinated wheat flour and bread with germinated sorghum and green gram had better keeping quality than the control samples (without added germinated flour).

Research Student: Sonakshi Meshram
Research Supervisor: Dr. Laxmi Ananthnarayan

Studies on development of Indian traditional foods

Taking into consideration the divesrsity of cultures in india. There are large numbers of traditional food products in india which require lot of cooking skills and consume time in preparation. Therefore in the present work development of karanji a popular Indian traditional confectionery was chosen, to provide the consumers a RTE/RTF form of this traditional food. The ingredients and process parameters for karanji preparation were optimized using one-factor-at-a-time approach which yielded optimized formulation with stuffing contatining semolina to sugar ratio of 1:1 (w/w), semolina to coconut shreds ratio of 1:0.75 (w/w), 5% (w/w) fat, 1.0% (w/w) oil and 1.5% (w/w) salt was added in the covering. Stuffing to covering ratio of 1:1 (w/w) was optimized with frying time of 90sec at 1800C. preservation of karanji was carried out using frozen storage for three different variants of kananji viz. ready –to-fry (RTF), par fried and full fried (RTE) and stored for 90 days at 20+20C. For RTF frozen karanji, PV and acid value changed from 5.50 to 10.2 meq/kg and 0.37 to 0.89mg KOH/g in 90days for RTE frozen karanji, PV and acid value changed from 5.50 to 12.8 meq/kg and 0.37 to 0.98mgKOH/g. all the three types of karanji were preserved using frozen storage upto 90days. Preservation was also done using pre-drying technique whrerin the karanji samples with 0.3% potassium sorbate and 0.3% citric acid incorporated were tray dried at 400C upto moisture content of 12% packed and stored for 30 days at 30+20C and 60% R.H. Acid value of these predried karanji samples increased from 0.21 to 6.23 mgKOH/g while TPC and YMC increased from 0.69 to 4.69 logcfu/g and 0.47 to 3.98 logcfu/g respectively. The selflife was extended only upto 20days. In case of ambient storage conditions of RTE karanji packed in LDPE and BOPP, at the end of 60days PV for BOPP and LDPE packed karanji samples was 15.02meq/kg and 20.53meq/kg while the acid value for BOPP and LDPE packed smaples was 1.20mgKOH/g and 2.50mgKOH/g. the self life was extended up to 40days when packed in BOPP pouches and stored at 30+20C and 60% RH. The oil uptake study was carried out using different types of frying medium and it was observed that the oil pick-up by karanji samples during frying was more when groundnut oil was used as compared to palm oil and vanaspati. Hydrocolloids such as guar gum, xantham gum and CMC were added to dough for outer covering with CMC addition at 1% (w/w) concentration reducing the oil uptake by 14.36%,

Research Student: Krati Dargah
Research Supervisor: Dr. S. S.

Arya

Omega-3 Enriched functional semi-sweet biscuit with flaxseeds

High widespread presence of chronic diseases such as cardio vascular disease, diabetes, cancer and obesity highlighted the need of functional food which should provide the basic nutrition and health benefits to consumers. In this scenario, flaxseed is a well-known functional food due to its excellent nutritional profile because of the presence of Omega-3 and omega-6 fatty acids, dietary fibers and lignans. And to fortify a product with flaxseeds, biscuit will be a smart choice. In the present research, efforts were taken to develop a –omega-3 enriched functional semi-sweet biscuit with flaxseeds by adding in 4 forms viz. raw (whole & ground) and roasted (whole & ground). Initially, all the ingredients and process parameters were optimized by varying one factor at a time methodology and then biscuits were prepared by using standardized ingredients and process parameters. Flaxseeds in all forms were varied as 5%, 10%, 15% & 20% by replacement of whole wheat flour in the recipe. Effect of addition of flaxseeds on dough stickiness, dough strength, color, hardness & fractruability, physical parameters and sensory parameters analysis and finally, a sensory analysis was conducted to choose the most acceptable sample among 4 and that was found to be biscuit was carried out and it was found that total dietary fiber content was increased to 9.70% in 20% ROWF WW-SSB, protein digestibility of 20% ROWF WW-SSB 68.50% was lower than control WW-SSb 75.60% and total polyphenols content was also increased. Optimised 20% ROWF WW-SSB was of low GI (44.08%) category. LA (omega-6) content was increased by 21.36% and ALA (omega-3) content was increased by 61.38%. further, storage stability of 20% ROWF WW-SSB andWW-SSB biscuits were carried out by monitoring moisture content, texture, FFA, PV and Sensory parameters and it was found that 20% ROWF WW-SSB can be stored up to 10th week at ambient temperatures without any deterioration in quality of biscuit.

M. TECH. (FOOD BIOTECHNOLOGY)

Research Student: Monika Rani

Research Supervisor: Dr. Laxmi Ananthnarayan

Studies in biomolecule profiling during the course fermentation of indian fermented food

Idli is a naturally fermented food prepared by blackgram and rice, which is consumed majorly in southern parts of India. It is very popular due to its spongy texture, sour taste and characteristic aroma. Various changes in biomolecules occur during the fermentation of idli which were monitored as a function of fermentation time. An increase in acidity with a corresponding decline in pH and rise in batter volume was evident during 20 hours of fermentation. A significant increase in amylase, protease and phytase activities was also observed. Reducing sugars and soluble proteins contents also increased. LAB and yeast count increased significantly during the fermentation of batter. A significant decline of 25% in trypsin inhibitor activity was observed. Rice plays an important role in idli preparation and since, it is consumed in ample amounts, it was worth replacing it with other cereals so as to look into the changes in biochemical and organoleptic properties of the batter. The replacement of rice with 25% ragi was optimized based on sensory evaluation. Further, 25% ragi each with 25% sorghum and 25% pearl millet were taken in order to perform 50% replacement. Rice replaced each with 25% ragi and sorghum showed the highest count of LAB and yeast as compared to control, rice replaced with 25% ragi, 25% ragi and 25% pearl millet. The higher microbe growth resulted in higher acidity and batter volume. Amylase activity was also highest in rice replaced each with 25% ragi and sorghum that can be related to higher concentration of reducing sugars while rice replaced each with 25% ragi and pearl millet resulted in higher protease and phytase activity. An increase in soluble proteins and a greater reduction in trypsin inhibitor activity by 49.9% as compared to 45.7% rice replaced each with 25% ragiand sorghum, 34% in rice replaced with 25% ragi and

25% in control batter was also observed. Rice replaced each with 25% ragi and pearl millet displayed highest antioxidant activity. Idlis prepared with cereal incorporation resulted in improved textural values and bulk density as compared to control idlis. Microbes play an important during the fermentation. The addition of mixed starter cultures, Lactobacillus plantarum and Saccharomyces cerevisiae was analysed on physico-chemical properties of idli batter and the final product quality. The addition of mixed starter cultures with cell density 103 cells/ml in batter resulted in achieving the values of 12 hours in control in 6 hours along with improved texture, color and bulk density.

Research Student: Himadri Pal
Research Supervisor: Prof. S.S.Lele

Studies on fermented mango products: Nata & Wine

India has the largest share for mangoes in worldwide production, but only the high quality fruits are accepted for export and by food processing industries. Utilization of the remaining mangoes for development of value added products using simple technology has been proposed in this study. Two novel products, Nata and wine, were developed from mango pulp obtained from a small scale industry in Maharashtra. Nata de mango, was developed by imitating the process for Nata de coco production, which has been conventionally produced by Acetobacter xylinum using coconut water. Nata de mango is pure bacterial cellulose and its procuction was optimized using factorial design of experiment. The optimum conditions for Nata de mango production are attained when pH is 4, ammonium sulphate is 1% and sugar is 3%. 61.2 g NDM can be produced per 100g pulp under optimum conditions. During the process, pH values reduce to 2.69+0.01 due to production of gluconic acids and a highly negative correlation is seen between the reducing sugar concentration and weight of the NDM produced. The productivity increases up to 5th day, but reduces thereafter because of reduction in substrate availability. A scale up of NDM production in presence of 0.3% sodium dehydroacetate gave a 123% increase in the yield per day. A RTS beverage was developed with the supplementation of 25% NDM. Pretreatment of NDM with NaOH for 25 minutes, followed by soaking in sugar syrup gave best results in terms of chewiness. The spent broth from NDM production was utilized for carotenoid extraction, and highest extraction (4.524+0.022mg/ml) was obtained with the use of ethanol in ratio of 1:10. The remaining mass could be used as a supplement for starter culture media if used at a concentration of 1% along with 2% sugar.

Second part of the study discusses malolactic fermentation in mango wines carried out by lactobacillus casei and it was observed that inoculation of mango wines on the 5th day of fermentation gives the best results in terms of optimal de-acidification (5.4%) and adds the ideal amount of buttery flavor to the wine. The colour stability of wines during shelf storage was analysed and all the wines showed darkening due to oxidation of flavones. Maximum darkening was exhibited by the wine co-inoculated with L. casei and wine yeast, whereas, the least darkening was in case of wine inoculated for MLF on 5th day. Inoculation of mango wines with L.casei for MLF gives best results when MLF is carried out for just one day. Both Nata de mango and mango wines seem to be promising ventures that can be commericialised.

Research Student: Shweta Tiwari
Research Supervisor: Prof. R.S. Singhal

Studies on synbiotic tea

Tea (Camellia sinensis) is one of the most popular beverages worldwide, and its consumption has been claimed to be associated with beneficial health effects such as anti-carcinogenicity, anti-mutagenicity, and cardio-protective effects. Ready-to-drink (RTD) ice tea is a ready prepared tea, mostly black or green, and generally consumed cold. Enzyme assisted extraction of green and black tea using cellulose, pectinase and their combination was carried out. A study undertaken to study the effect of enzymatic assisted extraction on the total solids, residual waste, total polyphenols and reducing sugars showed an increase in all the constituents,

and a very significant reduction in the residual waste. Ice tea samples were then formulated using a market sample as a model and inoculated with probiotic strains. The prebiotic activity scores of the samples were determined and the viability of the culture in enzymatic treated sample vs. control was also evaluated. Due to the in vitro generation of hydrolysed polysaccharides, the enzymatically treated ice tea samples showed them to be prebiotic in nature.

The screening of the strains, amongst lactobacillus acidophilus, lactobacillus plantarum and lactobacillus casei, was done for both green and black tea by checking their viability. Optimization of sugar levels in the ice tea samples was done using sensory analysis. The prebiotic effect of the ice tea was further augmented using commercial prebiotics like FOS, GOS, and inulin. Their combination was optimized (for both the teas) using mixture design studies and the responses evaluated were prebiotic activity score and probiotic viability. Symbiotic RTD ice tea was prepared by incorporating the optimized probiotic combination and its stability was evaluated over a period of 28 days. The beverage developed an unpleasant flavor during the shelf life, and therefore a premix format of the ice tea was also developed using sprey drying. The beverage prepared by reconstituting the prebiotic supplemented premix was evaluated and found to be sensorily and functionally acceptable.

Research Student: Mustafa Kazi
Research Supervisor: Prof.U.S. Annapure

Studies on fruit vinegars

Vinegar is defined as "A liquid fit for human consumption, produced from a suitable raw material of agricultural origin, containing starch, sugars, or starch and sugars by the process of double fermentation, alcoholic and acetous, and contains a specified amount of acetic acid." (Joint FAO/WHO Food Standards Programme, 1987). According to FSSAI brewed vinegar should have acidity not less than 3.75% as acetic acid.

The first step in vinegar production is alcoholic fermentation. Sugars are converted to ethanol by yeast (S. cerevisiae). The second step of vinegar production is aerobic fermentation where Acetic Acid Bacteria (AAB) converts ethanol to acetic acid. Important species of AAB include Acetobacter and Gluconoacetobacter.

The reaction is as follows

$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

$C_2H_5OH + O_2 \rightarrow CH_3COOH + H_2O + 493$ kJ

In this study, firstly, fruit (kesar mango, jackfruit, jamun, karwanda and banana pepper) juices were prepared, then alcoholic and acetic fermentation conditions were optimized. Alcoholic fermentation was carried out in 250 ml flask and anaerobic conditions were maintained with a water trap in a U-bend tube attached to the mouth of the flask with a rubber cork. Acetification was done in shake flask at 180rpm. Alcoholic fermentation with S. cerevisiae NCIM 3200 was carried out at room temperature (28 – 32oC) and maximum alcohol content (10.05 – 10.32%) was obtained in juice with 19oBx within 8 – 9 days with 1.5 – 2 % inoculum. A. acetiATCC 15973 was used for acetic fermentation and highest acetic acid yield (4.1 – 4.6%) was observed in wine with 7 - 8% alcohol content and 4% inoculum. Optimum acetification temperature was 25oC.

Physico-chemical characterization of fruit vinegars included analyzing color, acidity, antioxidant activity and analysis of flavor compounds using GC-MS. Color of vinegars were measured using Hunter lab colorimetry and acidity of the vinegars was measured using acid – base titrations. Total polyphenol content (TPC) and DPPH radical scavenging activity were analyzed for all juices, wines and vinegars. It was found that TPC and DPPH radical scavenging activity significantly decreased from juice to wine to vinegar, with karwanda being an exception. Of all vinegars highest antioxidant activity was observed in Jamun with a TPC of 7.36 (mg GAE/ml) and 10.98 (µmg/ml) followed by Karwanda, chili, mango and Jackfruit. Lastly, Profiling of flavor and aroma compounds using GC-MS was done, after extraction of non-polar compounds from vinegar using hexane. Most of the compounds identified using GC-MS were

long chain alkanes. Three alcohols viz. phenylethyl alcohol, dimethyloctanol and isosteviol were identified in jackfruit and mango, karwanda and chili respectively. Few carboxylic acids such as methylbutanoic acid, hexadecanoic acid and octadecanoic were identified. Also butyl and tributyl esters of citric acid were detected in fruit vinegars.

Descriptive analysis of vinegars (by taste and by odor) and discrimination test - triangle test (to differentiate between natural and synthetic vinegar infused with fruit pulp) were performed using 10 untrained panelists. All panelists identified the samples correctly as vinegar however; they couldn't correctly identify the fruit source. In the triangle test it was found that 80 – 100% of panelists were able to correctly identify the odd sample. But for Jackfruit none of the panelist correctly identified the odd sample. Also, majority of the panelist found synthetic fruit vinegar as more acceptable. Hence, due to high volatile loss and poor organoleptic properties of fruit vinegars brewed, it is concluded that submerged acetification, although being a quick method for production of vinegars, produces vinegars of poor aroma quality.

Research Student: Meera Chandru
Research Supervisor: Dr. Laxmi Ananthnarayan

Development of healthful food products for maternal nutrition

During pregnancy, the nutritional requirements of a woman increases in order to cater to the needs of the growing fetus. The inadequacy of certain micro and macronutrients affects the health of the mother and the fetus, and the adult it grows to be. These nutrients (protein, energy, calcium, iron, folic acid) should be given in adequate amounts to prevent maternal undernutrition. Plant sources such as finger millet, garden cress seeds, curry leaves, and spinach which are rich in these nutrients were subjected to various processing techniques to be developed into ingredients for natural fortification. Of all the techniques they were subjected to, soaked and pressure cooked ragi, and shade dried curry leaves retained the most Ca and Fe (346 mg/100g and 16mg/100; 602-604 mg/100g and 16.7-16.9mg/100g respectively). In garden cress seeds, processing did not cause substantial difference (9.4-9.8mg/100g) in the iron content. Folic acid content was higher in pressure cooked spinach samples. The bioavailability of these nutrients in the developed ingredients were characterized, and incorporated in products like biscuits (ragi, haliv), and thepla(spinach, curry leaves). In the case of ragi and haliv biscuits, 50% ingredient substituted products were found to give a substantial percentage of the RDA of the micro and macronutrients. They were also found to be sensorily acceptable as a result of the sensory evaluation performed. Storage studies were performed for the biscuit products, and they were found to retain their physical and sensory properties intact till 45days, in METPET pouches at room temperature. In the case of spinach and curry leaf thepla, 15% and 10% ingredient substituted samples respectively were sensorily acceptable, and provided substaintial percentages of RDA of nutrients so 50% ragi biscuits, 50% haliv biscuit, 15% spinach thepla and 10% curry leaf thepla were the finalized healthful food products developed for supporting maternal nutrition.

Research Student: Harleen Kaur
Research Supervisor: Prof. R.S. Singhal

Studies on food safety of cereal/legume based batters

Food-borne diseases (FBDs) are of serious concern worldwide. Among the disease causing bacteria, S. aureus is one of the major reasons causing gastroenteritis due to the consumption of unhygienic food. This kind of food poisoning is caused from the ingestion of food containing enterotoxins of certain strains of S. aureus. Hydrated batters which are produced in unhygienic conditions may cause the growth of S. aureus and other pathogenic microorganisms. When subjected to temperature abuse, they produce toxins detrimental for health. Hence it has become necessary to investigate this engraving problem and to further take steps to promote food safety. The aim of this study was to determine distribution and incidence of S. aureus in cereal/ legume based hydrated batters and their subsequent toxin

production potential. A total of 61 presumptive staphylococcal food isolates comprising of various species from 53 hydrated batter samples (17 Idli and 36 chick pea batters, respectively) collected from different areas of Mumbai were identified and characterized phenotypically. Due to heterogeneity among S. aureus isolates, ambiguous results were interpreted by relying mainly on biochemical tests. Hence, confirmation of the phenotypic identification of the food isolates and its definitive species identification was accomplished by using species specific markers targeting nuc, sa442 and fem B genes, being highly conserved among S. aureus strains. Out of the total 53 screened samples 64% of chick pea batters showed the presence of S. aureus which accounted to a total of 41% from 61 isolates. However, idli batter was found to be devoid of S. aureus. Strains confirmed to be S. aureus by both biochemical and molecular gene based PCR assays were evaluated for the prevalence of genes encoding classical enterotoxins. Among them, 12% of all tested strains were sea (n=2) and seb (n=1) positive.

Research Student: Swapnil Sutar
Research Supervisor: Prof.U.S. Annapure

Studies on effect of cold plasma treatment on the enzyme activity andinsect infestation of whole wheat flour

Cold plasma is an environmentally friendly technology that meets the presentecological requirements. Cold plasma has found as an effective for surface sterilizationand physical modification. There are many challenges related to whole wheat flourproduction, especially related to milling and storage. Milling reduces naturalcompartmentalization of lipids, and increase interaction between the lipids andenzymatic components thereby increasing rancidity. Shelf-life of whole wheat flour isshorter compared to white flour due to the presence of lipids and lipid-degradingenzymes.

Insect infestations of rust-red flour beetle, confused flour beetle, saw-toothed grainbeetle, Indian meal moth, drugstore beetle observed generally in plan-sifters, purifiers,separators and conveyors. Level of infestation in milled products increases accordingto the storage period in the retail market. The two varieties of whole wheat flour i.e.Lokwan and Sharbati were treated with cold plasma treatment in a low pressure bell-jar radio frequency (13.56 MHz) device for varied powers 40 and 60 W and exposuretimes of 10, 15, 20, 25 and 30 min. Lipase assay was optimized and effect of coldplasma treatment on lipase activity was determined. Samples were analyzed for waterand oil absorption capacity, foam capacity and stability, emulsion activity and stability,least gelation concentration, bulk density, amylase and protease activity. While thesamples of Lokwan analyzed further for insect infestation and shelf life studies. Also itwas analyzed for color changes and structural changes (FTIR).

There was significant increase in all functional properties except least gelationconcentration in both varieties. There was significant decrease in lipase activity. Thecold plasma treatment showed significant decrease in insect infestation. It alsosignificantly decreased moisture content, TBARS value, alcoholic acidity and insectinfestation over the storage period. The optimum power and time for cold plasmatreatment on whole wheat flour was found to be 60W and 25 min respectively. The coldplasma treatment can be used effectively to modify the functional properties andincrease shelf life of whole wheat flour and to prevent food loss by decrease in insect infestation.

Research Student: Pankhuree Singh
Research Supervisor: Dr. S.S. Arya

Functional probiotic beverage from multigrain

A major development in functional foods pertains to foods containing probiotics which enhance health promoting microbial flora in the intestine. Cereals being a cheap source of fermentable substrates, can act as good carriers for functional ingredients. Hence we have optimized the process parameters (including fermentation) for the development of probiotic beverage using various substrates viz., oat, barley, pearl millet and green gram. Single cereal substrate was prepared by subjecting it to various processes

such as roasting, gelatinization, and a combination of these. Out of these parameters, gelatinization was chosen on the basis of sensory acceptability for further studies. Following this, the process parameters for gelatinization of single cereal substrate were optimized and then thermostable α amylase was added for liquefaction of starch. Initially fermentation was carried out with natural probiotic (curd) and then, all four substrates were fermented with pure culture (L. plantarum). Optimized protocol for the development of single cereal based beverages included gelatinization of different flour (barley-5g, pearl millet-7g, oat-5g, green gram-5g) mixed with sugar (3g) at 950 C for 10min, followed by addition of thermostable α-amylase (60µl). Fermentation of enzyme treated gelatinized sample was done by inoculating with 1% starter culture for 8 hours at 370 C.

A multigrain product provides the nutritional benefits of the various substrates used for its development. Thus, mixture design was used to develop flour blends of selected grains to see the effect of grains in combination. In order to define the range of flours which could be incorporated in mixture, levels were optimized for different flours on the basis of sensory acceptability. In this context, responses (pH, probiotic count, sensory) which directly affect the overall acceptability of beverage were chosen. The design generated results based on multiple ingredient interaction. The resultant mixture of flour (barley-3.05g, pearl millet-2.98g, oat-1.96g, green gram-0.99g) was processed and fermented, and the beverage preparation was carried out and anlaysed for the same quality parameter.

Further these optimized single cereal based probiotic beverages and multigrain probiotic beverages were evaluated for its nutritional quality (proximate composition, mineral content, invitro mineral bioavailability, and in-vitro protein digestibility). It was found that optimized fermented probiotic beverages were having high protein content, low fat content, low carbohydrate content, high protein digestibility, high bioavailabiliy of minerals when compared to unfermented beverages and a study on estimation of shelf life on the basis of decrease in viability of probiotic microorganisms and change in pH have been done and shelf life of multigrain beverages found to be 24days.

Research Student: Sunayana Jadhav
Research Supervisor: Dr. S.S. Arya

Fermented probiotic drink from peanut meal

Peanut is one of the important crops in terms of oil production and rich protein content. Despite being rich in proteins most of peanut grown in world utilized for oil production. Peanut meal contains many fuctional compounds, such as protein, fiber and polyphenols as well as nutritional properties and health benefits. With respect to its high nutritive value especially being an excellent source of protein it can also be incorporated in many food preparations which can be supplied to populations suffering from hunger and malnutrition especially in the developing and underdeveloped countries.

Standerisation and optimization of various ingredients for development of fermented peanut meal (FPM) was done using one factor optimization methodology and further studies were carried out to check the effect of fermentation on FPM on sensory parameters. It was found that FPM containing peanut meal (10%) was the best formulation for FPM development. 13% mango pulp was added to reduce the sugar content of the FPM and also to add flavor to it. Further this optimized FPM was evaluated for its nutritional quality (Proximate composition, %IVPD, TIA, Tannins). Is was found that the optimized FPM had increased % IVPD and antioxidant values and also reduction in the values of tannins, TIA and Oxalates. This may be due to fermentation which enhances the nutritional quality of peanut meal. FPM had high dietary fiber content (9.12) and protein content (65.99) later storage conditions and their effect on various process parameters viz. pH, TA, viable count and color was also studied for 20 days. Samples were stored in PET bottles for storage studies and from the study it was found that probiotic can be stored at 40 C for 20 days. Hence, peanut meal probiotic can be used as alternative to

dairy based probiotic drinks. The production of probiotic drink from peanut meal could also add value to defatted peanut flour, a low value by-product of peanut oil production.

M.TECH. (BIOPROCESS TECHNOLOGY)

Research Student: Vikrant Bansode
Research Supervisor: Dr. S. S. Arya

Extraction, concentration and purification from protein peanut meal

Peanuts are among the important oil seed crops produced almost all over the world with India, China and USA leading in the production. Proper nutrition is a major challenge in developing and poor countries and requires immediate attention. A cheap protein source can aid in reducing the problem of malnutrition and also develop a new product. Peanut meal is a protein rich by-product of the oil industry which can serve as a cheap source of proteins for the preparation of protein concentrates or isolates. These proteins can be used as dietary supplements which will provide the oil industry with a value added product from a by-product. In this study, the effect of fermentation was assessed on the solubility and digestibility of proteins in the peanut meal. Three fungi namely N. sitophila, R. oligosporus and M. hiemalis were used for SSF of peanut meal. B. subtilis was used in SSF and SmF of peanut meal. Results showed a decrease in protein solubility and digestibility which led to the conclusion that direct fermentation of peanut meal with these organisms was not desirable as the extractable protein content decreased along with the digestibility. Hence, direct extraction of proteins from peanut meal was carried out using 0.02M phosphate buffer (pH 8.0) which was optimized using RSM. A 2 factor interaction model was found to be suitable for designing an extraction procedure and the optimized parameters were used to extract proteins on a larger scale where about 70% yield was obtained. Protein concentrates were prepared using isoelectric precipitation which precipitated 82.93% of the available proteins. An overall percent yield of 94.18% was obtained and the precipitate was found to be 81% protein. A food application was attempted using the protein concentrate by preparing protein supplemented biscuits. Biscuit with the highest concentration of the concentrate (9%) was found to contain less than 4 ppb of aflatoxin and hence was safe for consumption. Sensory analysis of the biscuits concluded that improvements are needed with the way peanut protein concentrates are used in food items.

Research Student: Priyanka Shinde
Research Supervisor: Dr. J.S.Gokhale

Enzymatic biotransfomation for improving antioxidant property of lemon

Citrus fruits juices are largely consumed by people because of their high content of vitamin C and phenolic compounds which are having high health benefits. Annual production of all types of citrus fruit worldwide is over 110 million tons, covering an area of nearly 18.7 million acres. Among these around 13.7 million tons of lemons and limes are produced. According to FAOSTAT in 2014, production of lemons in India was higher (2.8 million tons) than other lemon producing countries. It has been reported that the tannase extract was able to modify the polyphenolic composition of the citrus juice and remove the glycosides. The tannase enzyme, obtained from Aspergillus niger Van Tighem, was used for biotransformation of the lemon polyphenols and, in this way, modifying their biological activity. The results of the enzymatic reactions of the hesperidin and lemon samples were products with heightened functional activity in relation to the original samples, as demonstrated with in vitro tests of antioxidant activity (DPPH). But it has been seen that commercially available tannase as well as tannase from A. niger Van tighem was not able to biotransformed the polyphenols and some other enzyme was biotransforming the polyphenols. Determination of that unknown enzyme is future scope of this research work.

Research Student: Farah Naz
Research Supervisor: Prof. U. S. Annapure

Isolation, purification and characterization of lipase from saccharomyces boulardii

Lipases show catalytic activity in both aqueous and non-aqueous media and hence are an important group of biotechnologically relevant enzymes. They have long and diverse list of applications in industries such as detergent, oleo-chemical, organic synthesis, dairy, pharmaceuticals, fat and oil modification, etc. Among microbial lipases extensive reviews are available on bacterial lipases. Yeast lipases have received a raw deal despite the fact that Candida rugosa is the most frequently used organism for lipase synthesis. The information on numerous other yeast lipases is scattered. Research on lipases is focused particularly on structural characterization, elucidation of mechanism of action, kinetics, sequencing and cloning of lipase genes, and general characterization of performance. In comparison with this effort, relatively little work has been done on development of robust lipase bioreactor systems for commercial use. Medium optimization for overproduction of the lipase is an important step for its commercial usage and involves a number of physico-chemical parameters such as the composition of production medium, the carbon and nitrogen sources, type of surfactant and its concentration, pH and temperature and time period of fermentation. In this study, the work is done on the medium optimization using the one-variableat-a-time for the production of intra and extracellular lipase from Saccharomyces boulardii and then comparing its lipase activity with that of Saccharomyces cerevisiae keeping the same optimized fermentative parameters for both. Further, the intracellular lipase extracted was purified using ammonium sulphate precipitation followed by dialysis. Also the enzyme was concentrated by ultrafiltration after which the lipase activities of the dialysed enzyme solution and ultrafiltered enzyme solution were compared. The purified lipase was then characterized by studying the effects of different metal ions, pH and temperature on its stability. Further, experiment was done to check the potential of the lipase in interesterification of oils and fats to be used in food industry.

M.TECH. (GREEN TECHNOLOGY)

Research Student: Poonam Sutar

Research Supervisor: Dr. J.S.Gokhale

Biosorption of heavy metal ions using novel biosorbents

The abscised coconut leaves (ACL) powder was tested for its ability to remove chromium (VI) from aqueous solution by batch and column experiments and its application to industrial waste water effluent. The maximum biosorption capacity of the ACL powder was 28.95 mag/g at pH 1, particle size 0.355mm, sorbent dosage 10 g/l, initial Cr (CI) and concentration of 100mg/l with 99% removal efficiency. The physicochemical properties of all the adsorbents were studied using different characterization techniques such as FTIR, SEM, EDAX, BET surface area zeta potential and point of zero charge. The EDAX analysis revealed the presence of chromium ions of about 18.36% on mass basis. The present study also investigates the equilibrium conditions, thermodynamic parameters and column modeling. Evaluated $\Delta G0$ and $\Delta H0$ specify the spontaneous and endothermic nature of the adsorption. The adsorption takes place with a decrease in entropy ($\Delta S0$ is negative). The kinetics of biosorption best fitted the pseudo second order model. The ability of the ACL powder to adsorb chromium (VI) in packed bed column was investigated. The data confirmed that the total amount of sorbed chromium (VI) and equilibrium chromium (VI) uptake decreased with increasing flow rate and increased with increasing inlet chromium (VI) concentration. The Thomas, Yoon-Nelson and BSDT model were used to analyse the experimental data and the model parameters were evaluated by non-linear regression.

SEMINAR/ CONFERENCE/ WORKSHOP ATTENDED BY RESEARCH STUDENTS

- Mihir Desai, Akshata Gadhave, Pravin Bhushette, Kriti Dubey, Rohit Kulkarni, Hemant Borase, Varahkumar S., Anu Ahlawat attended the Workshop on Food Entrepreneurship Development organized by food engineering and

technology department, ICT & AFST, (Mumbai Chapter) under TEQIP program on 12th August, 2016 at ICT Mumbai.

- Sachin Adsare, Bhushan Chaudhari, Aarti Ghanate, Ashlesha Bhagwat, Vaishali Mishra, Pratiksha Avhad, Aroshi Sharma, Bulbul Vij, Momin Bilal, Suman Kumari, Sowmya R.S., Bhupendar Singu, Prajakta Insulkar, Chetan Arekar, Mihir Desai, Deepak Kadam, Said, Majid Jamkhani, Anamika Banerjee, Vardan Singh, Bhupinder Takare, Pravin Bhusette attended a Seminar "Prof. D.V. Rege Memorial Seminar Nutraceuticals-Science to Business" organized by food engineering and technology department, ICT & AFST, (Mumbai Chapter)under TEQIP program supported by world bank held on 15th February, 2017 at Hotel Peninsula Grand, Andheri (East), Mumbai.
- Ph.D.(BC)- chandrahas vishwasrao and M.Tech. (FBT)- Sruthy Joy, Saaylee Danait, Deepanshu garg Students of Food Engineering and Technology, ICT actively participated in BEST-ABLE Contest 2016 organised by DBT.
- Cheryl Fernandes, M.Tech attended a Workshop on Food Entrepreneurship Development" organized by FETD, ICT & AFSTI (Mumbai Chapter), ICT Mumbai, Aug 12, 2016
- Cheryl Fernandes, M.Tech. Attended a Workshop on Fruits and Vegetable Processing Opportunities in Maharashtra, ICT Mumbai Sep 27, 2016.
- Sachin R. Adsare, Abhijeet B. Muley presented in National Expo"STORY OF MAKERS"on "Animal feed from agro food proceessingindustry waste"at SHBSK Jain Chhatralaya, Matunga, Mumbai.
- Abhijeet B. Muley participated and Secured Consolation Prize in PSG - NANO CHALLENGE - 2016 organised by PSG institute of Technology, Coimbture and College of Nanoscale sciences and Engineering, State University New York Polytechnic Institute, USA .
- Abhijeet B. Muley and Team Secured Best Organizing Team Award for the event "PAPYRUS" in "VORTEX 2016" held at ICT, Mumbai.

ACADEMIC PERFORMANCE AWARDS

- Protein Food and nutritional development Association of India Scholarship (Merit cum Means) to Mr. Rushabh Gowardipe in B. Tech. (Foods).
- Professor P.J. Dubash Memorial – AFST (I) Mumbai Chapter Award to the B.Tech. (Semester IV) student from Food Engineering and Technology Department for securing highest marks in the subject of Food Chemistry (Theory), awarded to Mr. Rushabh Gowardipe
- The Association of Food Scientist and Technologist (I) Bombay Chapter Award to Ms. Anjali Chahal for first rank in B. Tech. (Foods).
- AFSTI award fror student Mr. Shunham Goyal and Sumita Kumari

COCURRICULAR AND EXTRACURRICULAR AWARDS

Sr.	Name of Student	Class	Event	Activity	Prize
1.	Niharika soni Vrushti Shah	M.Tech. SemIII	Innovation Premier league-Oct 2016 (AFST)	Idea presentation	5000/-
2.	Abhijeet Muley Ketan Mulchandani	Ph.D	Sportsaga, ICT –March 2017	Cricket Team	Final Winner

3	Abhijeet Muley	Ph.D	Funtech - February 2017	Badminton Doubles Mens	Final Winner
4	Abhijeet Muley	Ph.D	Yuvam 2017	Dart Team of 5	Final Winner
	Sachin Adsare				
5	Divya M.	M.Tech	Yuvam 2017	Cricket Team	Final Runner up
	Priyanka Sawant				

(* Indicates woman student)

BATCH OF 2017

1) Anas Ejaz Shaikh –

Best Paper (First Prize) in Poster Session at International Conference on Environmental Management & Sustainability (ICEMS) 2017 for project entitled 'Conjugated Linoleic Acid production by Lactic Acid Bacteria: A bio-transformation study in medium with Castor Oil Hydrolysate' at Nerul, Navi Mumbai held from 6th-8th January, 2017.

BATCH OF 2018

1. Shubham Sawardekar
   Silver Medal in Kick Boxing-Light Contact, ICT, Sportsaga-March 2017

   Bronze Medal in Kick Boxing- Point Contact, ICT, Sportsaga-March 2017
2. Ruchir Manoj Agrawal
   Revive and Survive 2nd Position,ESummit Ecell ICT 2017

   IDP Question 'C' First Prize,Rangotsav 2017

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)

	Graduates Employed		Higher Studies	
Year	Passed	Industry	India	Abroad
2013	17	5	1	3
2014	18	12	2	3
2015	16	4	1	6
2016	16	4	3	6
2017	16	7	01	04

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

	Masters Employed		Higher Studies	
Year	Passed	Industry	India	Abroad
2013	15	07	-	-
2014	21	08	-	01
2015	21	06	-	-
2016	22	14	-	-
2017	22	11	-	-

PLACEMENT OF PH.D. (TECHNOLOGY / SCIENCE)

	Doctorates Employed		Higher Studies	
Year	Passed	Industry	Academics	Abroad
2013	3	1	-	-
2014	9	4	2	-
2015	8	4	3	1
2016	12	5	3	-
2017	3	-	-	-

CAMPUS PLACEMENTS 2015-16

Sr.	Company	Student	Degree
1.	Das Rahel Suchita	Ruchi food	M.Tech (FET)
2.	Banura Sidhant	Keva Flavours	M.Tech (FET)
3.	Bhat Yuga	Alfa Laval	M.Tech (FET)
4.	Mohurle Ashwini	Ankush Enterprise	M.Tech (FET)
5.	Ghorpade Dhananjay	Keva Flavours	M.Tech (FET)
6.	Choudhary Himanshu	Ferminich, Jogeshwari	M.Tech (FET)
7.	Meshram Sonakshi	VKL Pvt. Ltd.	M.Tech (FET)
8.	Pal Himadri	Parle Agro	M.Tech (FBT)
9.	Tiwari Shweta	Mondeleze Cad	M.Tech (FBT)
10.	Kazi Mustafa	VKL Pvt. Ltd.	M.Tech (FBT)
11.	Meera Chandru	Mondeleze Cad	M.Tech (FBT)
12.	Dhaliwal Harleen	Keva Flavours	M.Tech (FBT)
13.	Singh Pankhuree	Keva Flavours	M.Tech (FBT)
14.	Jadhav Sunayana	Ruchi food	M.Tech (FBT)
15.	Anjali Chahal	General Mills	B.Tech (FET)
16.	Barure Bageshree	VKL Pvt. Ltd.	B.Tech (FET)
17.	Tarkas Akshara	Pepsico India	B.Tech (FET)
18	Poornima Vijayan	Heinz	B.Tech (FET)
19	Rutuj Kulkarni	General Mills	B.Tech (FET)
20	Rohit Surose	Vinayak Food	B.Tech (FET)
21	Malhar Kadam	Parle Agro	B.Tech (FET)

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

SUMMER PLACEMENT

Sr.	Student	Class	Place/Project	Period (May 15, 2017 to June 30, 2017)
1.	Ankit Dhelriya	S.Y.B.Tech.	ICT/Effect of various gums on properties of extruded corn grits under Prof. U.S.Annapure	3 Months
2.	Ankita wadhe	S.Y.B.Tech.	ICT/Estimation of Polar compounds in potato based food items under Prof. Rekha Singhal	3 Months
3.	Somnath Basak	S.Y.B.Tech.	ICT/ Effect of various gums on properties of extruded corn grits under Prof. U.S.Annapure	3 Months
4.	Claudia Samual	S.Y.B.Tech.	ICT/ Effect of various gums on properties of extruded corn grits under Prof. U.S.Annapure	3 Months

CO-CURRICULAR EVENTS

DASSARA PUJA 2016

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 with an aarti and floral offerings to goddess Saraswati. Professor G. D. Yadav, Vice Chancellor, ICT paid their visit to the function. This was followed by enthusiastic performances by many department students wherein they sang songs and performed dances from different genre. The auspicious occasion concluded with hearts filled with happiness and peace.

WORKSHOP ON ENTREPRENEURSHIP DEVELOPMENT: DARE TO DREAM

A one day workshop was joitly

organized by ICT under TEQIP and AFST Mumbai Chapter on "Food Entrepreneurship Development: Dare to Dream on 12th August 2016 at ICT. Small and medium enterprises (SMEs) have been the backbone of the Indian economy. SMEs employ close to 40% of india's workforce and contributing 45% to india's manufacturing output, SMEs play a critical role in generating millions of jobs, especially at the low-skill level. The country's 1.3 million SMEs in india, due to their low scale and poor adoption of technology, have very poor productivity and face many challenges in marketing, supply chain among others.

This workshop was held to guide students, new and budding entrepreneurs on various aspects of business. The program was formally inaugurated with lighting of lamp, prof. Annapure and Dr. Prabodh Halde welcomed everybody and explained about activities of ICT and AFST. Prof. Rajesh Sharma Member, National Board for micro, small and medium enterprises, Govt. of India was the chief guest at the event. He talked about various policies started by the government and MSME department. He urged all entrepreneurs to enroll under udyogaadhar. This years first newletter of AFST was released by all the dignitaries on the stage. Prof. Smita lele was also felicitated for being awarded the Unch Maza Zoka award, highest award for woman achiever in science and technology. Mr. nilesh lele, ICT alumnus and Secretary of AFST Mumbai raised a vote of thanks for the opening session.

The event was a great success and attended by 100+ students and 180+ total delegates. Dr. Snehasis Chakraborty, Assistant Professor ICT and Treasurer of AFST Mumbai raised a formal vote of thanks.

INTERACTION PROGRAM FOR PG STUDENTS

Prof. Uday Annapure organized the interaction of PG students with Prof. Kathiravan Krishnamurthy, Assistant professor, Department of food science and nutrition, institute of food safety and health, Illinois Institute of Technology (IIT) , Chicago USA & Dr Prabodh Halde, President AFST. Dr Kavthiravan gave very informative presentation on non thermal techniques and Dr Prabodh Halde talked about project Avishkar and innovation. Dr Snehashish Chakraborty, treasurer AFST Mumbai offered a vote of thanks. Event held at ICT, Mumbai on 18th August, 2016.

NUTRITION WEEK REPORT

The staff, students of ICT (FETD) and other colleges all over Mumbai gathered to celebrate Nutrition Week on Wednesday, August 31, 2016 at 10 am in ICT premises, which was organized by Association of Food Scientists And Technologists (AFSTI) jointly with Food Engineering And Technology Department, ICT. Whole program was supported by AAK Kamani private limited, Mumbai. The program was run under a theme 'first thousand days of life'. Many events were held on the same day viz. poster competition, debate competition and skit competition. All events were based on a theme; as "galactagogues" was theme for recipe competition, "Foods that protech heart" was for poster compition, "Malnutrition in India" was for skit competition and changing food habit: impact on human nutrition/traditional home cooking is being outdated. Yes or no" was theme for debate competition. Many students from different colleges had participated in these events. All winners were awarded by cash prizes. Colleges, participated in events, were G.N. Khalsa Collge of arts, science and commerce; Ramnarayan Ruia College; Dr. BMN college of home science and anjuman-i-islam college, Mumbai.

Along with these competitions, an interactive session was also kept there in which many delegates had interacted with the students and faculty. They gave a very nice explanation to audience about nutrition in today's lifestyle. Dr. Subha Nishatla, gave a brief presentation on "importance of quality in food system". Dr. Gauri Iyer, specialist from AAK Kamani private ltd, had mentioned "Role of oils & fats in infant and young child nutrition". Also, Dr. Nilesh lele, president of AFST, Mumbai Chapter introduced project Avishkar to the audience.

SEMINAR ON PLAM OIL...

The FETD, ICT and Malaysian

palm oil board jointly organized a seminar on palm oil which was supported by AFST(I), Mumbai chapter. It was held on 30th January, 2017 at the Dr. K.V.Auditorium. The Inagural session was attended by guest of honour, Prof. G.D.Yadav, V.C., ICT, Chief guest Mr. Eldeen Huaini Mohd Hashim, counsil general of Malasia in Mumbai, Dr. Nagendran Bala Sundram, MPOB Regional Manager (South Asia) and prof. Uday Annapure, HOD, FETD,ICT. The seminar had technical sessions on topics such as introduction to palm oil and its application, value addition to palm products, nutritional and health attributes of palm oil.

WORKSHOP ON INSTRUMENTATION FOR FOOD ANALYSIS

A workshop on 'Analytical and preparative instrumentation for the food industry' was conducted by anton par on 27th February, 2017 in the dept. food engineering and technology (FETD), ICT, Mumbai. The objective of this workshop was to help students to find the best solution for trace element analysis of food ingredients, quality checks on flavours and sophisticated analysis of mouth-feel, mixing and stirring behavior. The workshop was a great success and benefited the students immensely. The topics covered included: Rheology in food applications of refractometry in food, trace analysis of heavy metals in food, followed by a live demonstration session.

SEMINAR ON NUTRACEUTICALS: SCIENCE TO BUSINESS

The FETD, ICT and Association of food scientists and technologists (India), Mumbai chapter jointly organized the prof. D.V. Reve memorial seminar 'Nutraceuticals: Science to Business' under the TEQUIP programme on 15th February 2017 at hotel peninsula grand, Andheri(E), Mumbai. Dr. V. Prakash, scientist, CSIR India, Prof. G.D.Yadav, V.C., ICT, Prof. Smita Lele, registrar, ICT, Mr. Arun Sharma, Senior consultant, food safety and standards Authority of India(FSSAI), New Delhi, Mr.Suresh Annapure, joint commissioner, food and drug administration (FDI), Maharashtra, Prof. Uday Annapure, Head of the FETD, ICT and Dr. Prabodh Halde, President, AFSTI Mumbai Chapter were present at the inaugural session.

There were technical sessions on various aspects of nutraceuticals Mr. Arun Sharma spoke about nutraceutical regulations, Dr. Bhaskarachary, Assistant director, National Institute of Nutrition, Hydrabad, spoke about nutrition and health claims. Dr. Arun Balakrishnan, Chief scientific officer, omniactive health technologies spoke on global trends in nutraceuticals and antibiotics against infectious diseases. At the end, there was a panel discussion on opportunities and challenges in nutraceuticals.

HANDS ON TRAINING FOR ANALYSIS OF FOOD BIACTIVES

The FETD, ICT organized a hands on training for analysis of food bioactives on 2nd -4th March, 2017 with the assistace of Tequip. The workshop was co-ordinated by Dr. Shalini Arya and her team of post graduate and Ph.D. Students. Industry professionals, acedemicians and scientists from reputed institutes attended this workshop. Lectures were conducted on topics such as bioactives of carbohydrate and pigment origin, fruit based bioactives, prebiotics and probiotics and data interpretation using statistical analysis. The participants god hands of training in analysis of resistant starch, dietary fibres, carotenoids, polyphenols, anthocyanins and antioxidant activity. In vitro analysis of Glycemic index(GI) of food, analysis of bioactives by HPLC and DSC, Effect of processing on food bioactives, analysis of food bioactives(isoflavours) by HPTLC and GC analysis of biactives (omega acids) were demonstrated. The feedback received from the participants was overwhelming and all the sessions of the workshop were appreciated. We hope our department will have many more of such workshops in the future!!

BEST- ABLE COMPETITION 2016

Ph.D.(BC)- chandrahas vishwasrao and M.Tech. (FBT)- Sruthy Joy, Saaylee Danait, Deepanshu garg Students of Food Engineering and Technology, ICT actively participated in BEST-ABLE

Contest 2016 organised by DBT. The idea on molecularly imprinted polymer for delection of aflatoxins got selected under top 20 teams all over india and qualified the initial screening. Students were therefor called for an enterprenual workshop in Delhi on 19-22th February, 2017. Where the workshop has aimed at training the students on patents, licening, funding and strategic financial management on the proposed business idea. Students interacted with the larg giants in the area of biotechnology and returned back with goods of memories.

SUMMER RESEARCH FELLOWSHIP PROGRAM 2016 UNDER IASC-INSA-NASI:

1. Ms. Mrithula Mahalakshmi M

   A short project of 8 weeks on 'Extraction of lutein from marigold flowers using three phase partitioning' was undertaken by the candidate. The summary of the work is as follows:

   The yield of lutein from marigold flowers through conventional solvent extraction using hexane was found to be higher than TPP. Attempts were made to improve the yield in TPP by mixing t-butanol with hexane in 9: 1 ratio which gave promising results. This technique will result in high yield at the same time reduce the use of hexane to a greater extent. TPP will be a solution for extraction using least usage of hexane and other hazardous solvents. The t-butanol used in extraction can be recovered through rotatory evaporator. This study shows that TPP is economical method of extraction and can be considered for commercialization.

2. Ms. Harshita Arora

   A short project of 8 weeks on 'Extraction of piperine from black pepper using three phase partitioning' was undertaken by the candidate. The summary of the work is as follows:

   Optimization of certain parameters like ammonium sulphate concentration, pH, slurry to t-butanol ratios, solid load, incubation time and enzyme action was carried out to check the effect of various parameters on the yield extracted of piperine by three phase partitioning. The parameters were analyzed by keeping one-factor variable with keeping all other constant. Maximum yield of extracted piperine was optimized at 40% ammonium sulphate at pH 7 with t-butanol to slurry ratio of 1:1.5, 15% solid load, 0.1% Viscozyme for 2.5 h. When compared with Soxhlet extraction (control), there was a significant increase in the yield recovered by TPP. Therefore, TPP proved to be the appropriate, economical and simple technique.

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-JUNE 2017

Sr.	Student Name	Project Name	Company For IPT	Place
1.	Ashishkumar Darji	Tomato ketchup downtime production, machine speed and material balance calculations	Mapro Foods	Wai
2.	Chinmay Kinage	cocoa powder alkalization and its application in compound chocolate	Tata Chemical Limited	Pune
3.	Ruchir Agrawal	Production at Schreiber dairy	Schreiber Dairy Dynamix	Baramati

4.	Ruchira Gangurde	-	Raptakos and Brett	Thane
5.	Noopur Mehta	Centrelining of the new CSD PET line	Pepsico	paithan
6.	Meenakshi Gupta	Re-formulation of count line product recipe to comply with new FSSAI standards	Mondelez India	Thane
7.	Manish Chauhan	R&D Work in 'Increasing the Acidity of Kokum Fruit Concentrate'	Dr. Hedgewar smruti seva prakalp	sawantwadi
8.	Shubham Sawardekar	optimization of jam line	Mapro Foods	Wai
9.	Vaishnavi Patki	Worked with Quality Assurance team on the projects pertaining to 'Packaging quality improvement'	Pepsico	Ranjangaon
10.	Vaidehi Narkar	Development of self stable RTE Chocolate sponge cake	General Mills	Vikhroli
11.	Shubham Purandare	Calculate& optimize batch time on chocolate & cocoa lines.	Morde Foods	Manchar
12.	Gautamraj Dadlani	To calculate and analyse the end to end losses during meat processing thereby suggesting the suitable method to minimize the same	Vista Foods Pvt. Ltd.	Mumbai
13.	Rohit Jorigal	Formulation of egg free chocolate muffins	General Mills	Vikhroli
14.	Pranav Raval	Production at Schreiber dairy	Schreiber Dairy Dynamix	Baramati
15.	Yash Kakani	R&d work on manufacturing of gellan gum using fermentative methods	Tata Chemical Limited	Pune

IN-PLANT TRAINING: M. TECH (FOOD ENGG. & TECH.) MAY-JUNE 2017

Sr.	Student Name	Course	Industry	Project Name
1.	Abisheka Pandian T.	FET	SNP Dairy Milk, Madurai, Tamilnadu	Study of effect of beetal leaves on shelf life of khoa
2.	Harshal	FET	Mondelez, Mumbai	Worked in Research and development Department on Project "Gems New Colour Promo Trial"
3.	Kakoli Pegu	FET	General Milk, Mumbai	New product development and valiadation: whipped topping mix, egg free tea time chocolate mix
4.	Kapil Rai	FET	Tata Chemicals, Pune	Application of cocoa powder in whey protein premix and its comparison with similar market product

5.	Kishori Balu Panmand	FET	Paradigm, Mumbai	Laboratory setup for quality control of fresh and frozen bakery products and Development of formulation for frozen cookie dough
6.	Krutika Anil Bhangale	FET	Mondelez, Mumbai	Quality evaluation checks on caramel to establish newer composition trials
7.	Nivedita N.V.	FET	United Spirits Ltd., Banglore	Process optimization of alcohol production from the grain sorghum
8.	Rishab Dhar	FET	Innoventur, Mumbai	Development of new protein based pwder premixes, food bar and food gels
9.	Shubham Goyal	FET	-	-
10.	Sneha Awasthi	FET	Mondelez, Mumbai	Silk shell renovation and chocolate grammage reduction by using low density inclusions
11.	Saee Nikam	FET	-	-
12	Alisha Sukhija	FBT	Mondelez, Mumbai	Screening of new emulsifiers for use in liquid chocolate making.
13	Harsha Jagdish Bharwani	FBT	Nestle, Goa	Reduction of fallen bars and alternative utilization of rework.
14	Mukesh Kumar Patel	FBT	OmniActive Health Technologies Limited. Pune	Isolation and quantification of Aflatoxins in some food samples and OmniActive products using TLC and HPLC. And DPPH (2, 2-Diphenyl-1-Picrylhydrazyl) free radical assay for determination of antioxidant activity formulation of OmniActive products.
15	Nitin Sukhdev Sangle	FBT	Mondelez, Mumbai	Nutrition profile modeling
16	Prabhat Chauhan	FBT	ITC, Banglore	Centre for Quality Assurance Laboratories; Quality of Snacks and Atta
17	Sana Jameel Shaikh	FBT	Tata Chemicals, Pune	Flour Treatment for cake and cookies, cake and cookie development and optimization
18	Shaikh Lubna Bagum	FBT	Marico Industries, Mumbai	Spray drying of coconut water to powdered form
19	Shraddha Srinivasan	FBT	ITC, Banglore	Centre for Quality Assurance Laboratories; Quality of juices and its raw materials
20	Shubham Bharat Gaikwad	FBT	Nestle, Goa	Rework reduction of KitKat production.
21.	Sumita Kumari	FBT	VKL Spices, Mumbai	Quality of sweet goods

We would also like to thank the following persons/organizations for their generous support through donation to the FETD.

DONATIONS

Sr.	Person/Company	Amount (Rs.)
1.	Foundation for innovation & social int.	25000/-
2.	Lucid Colloids Pvt. Ltd./Sanjay Modi	2700/-
3.	Bisleri International Pvt. Ltd.	52500/-
4.	Sonal Naresh Choudhari	6000/-
5.	Priyanka Jadhav	6000/-
6.	Gurunath vasudev mote	6000/-
7.	Abhishek Shukla	6000/-
8.	Rochelle colaco	6000/-
9.	Ayushi jain	6000/-
10.	Karan Patel	6000/-
11.	Nilam Tukaram Kate	8000/-
12.	Shabnam Umar Ali	8000/-
13.	Sneha methar	8000/-
14.	Devyani Jitendra Unhone	8000/-
15.	Kanchan Nikam	6000/-
16.	Ramesh Fulchand Chavan	6000/-

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 Commision (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