Dear Sir,

I am working as a Senior Scientific Officer, at DBT-IOC Centre for Advanced Bioenergy Research, Indian Oil Corporation Ltd., Faridabad, Haryana, India. I have done Ph.D. in Biochemistry with specialization in Molecular Biology and Genetic Engineering.

My present role is managing, procuring and maintaining lab equipments for carrying out laboratory experiments, preparing reports and test results in consultation and collaboration with other teams on related projects. I develop standard operating procedures, train scientists and enforce safety compliance in laboratory. I am engaged with setting up a Demonstration scale (1 ton/day) plant to produce second generation bioethanol production from lignocellulosic biomass. This model shall help in setting up 3 full scale commercial plants (10 ton/day) for bioethanol production in near future.

The present area of **high priority area is biomass derived technical lignin valorizatio**n. I am developing an integrated process where, lignin gets converted to high value product via biochemical and chemical based approaches. The targeted molecule is dicarboxylic acids, bioplastics and nanomatrials. I have expertise in biomass extracton process and **NMR, FTIR, UV/Vis spectroscopy, GC and LC-MS**. I am involved in the projects that deal with preparation of delignified cellulose and of lignins from differently pretreated biomass samples characterization of different, and characterization of biomass (glucan, xylan, lignin etc.) and lignin (S/G ratio, hydrophobicity) with the aim to study enzyme- lignin binding and Langmuir isotherms.

I also worked on biomass saccharifying enzymes for bioethanol production using commercial and in-house developed enzymes (wild/ muants). My work emphasizes on cost- reduction of enzymes via different approaches (preparing potential cocktails of synergistic enzymes, immobilization of enzymes on polymers/ nanoparticles, recovering the enzymes from enzymatic hydrolysates using ultrafiltration techniques and reducing the non-productive adsorption of enzymes on lignin by adding cheaper surfactants). I have expertise in enzymatic saccharifiaction at large scale (upto 20 L reactors) and analysis of hydrolyastes for hydrolysed (monomers) and unhydrolyzed (oilgomers) sugars. I also have little knowledge of pretreatment at pilot scale (feed rate 250 Kg/day).

The development of process for simultaneous saccharification and fermentation is another objective of my research. I have experience of different enzyme assays and enzyme kinetics studies to determine km and vmax. I have sound knowledge of native/ SDS gel electrophoresis, zymogram, column chromatography, HPLC/GC.

I am interested in working with your group as I found that my consultation/research experience deeply coincides with job requirements.

Please find attached my CV for your kind perusal.

Regards,
Ruchi Agrawal

Biochemistry (Ph.D.)
DBT-IOC Centre for Advanced Bioenergy Research
Faridabad, Haryana, India
Website: http://dbtiocberc.org.in/
Email: dr.ruchiagrawal010@gmail.com

CURRICULUM VITA

DR. RUCHI AGRAWAL
SCIENTIFIC OFFICER

DBT-IOC Cente for Advanced Bio-Energy Research
R&D, Indian Oil Corporation Limited, Sector-13, Faridabad-121007
dr.ruchiagrawal010@gmail.com, ☎ (+91) 9716362808

Objective

Intend to build a career in academics or industries and work with committed & dedicated people, which will help me explore my skills. Will to work as a key player in challenging & creative environment.

Strong points

- Energetic self-starter with good analytical, public relations skill.
- Able to conduct independent research, maintain excellent records and manage complex data sets
- Outstanding verbal and written communication skills
- Able to work in a team environment and effectively interact with colleagues
- Demonstrated publication record
- ***9 Years of Research /Teaching experience***

Personal Profile

Nationality	Indian
Date of Birth	1st October 1983
Sex	Female, Married
Languages Known	Hindi, English and German.
Address	Flat No. 402, Block C-5, Puri Pranayam, Faridabad, Haryana, Pin-121002, India.

Education

Ph.D (Biochemistry) (with **Molecular Biology & Biotechnology** as Minor subject)	Govind Ballabh Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India. (www.gbpuat.ac.in) (*Thesis Title: Enhanced production of β-glucosidase by chemical and UV- mutagenesis and its application after immobilization on SiO_2 nanoparticles*)	2012 77%
M Sc. (Biophysics)	Govind Ballabh Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India. (www.gbpuat.ac.in) (*Thesis Title: Development of an Immunosensor for the Detection of Cadmium Resistant Rhizobacteria*)	2007 81%

Research/Teaching Experience

Scientific Officer (September 2017- Continued)	DBT-IOC Advanced Bio-Energy Research Centre, R & D Indian Oil Corp. Ltd., Faridabad, Haryana, India. (*www.dbtiocberc.org.in*)

Research Associate (April 2013- August 2017)	DBT-IOC Advanced Bio-Energy Research Centre, R & D Indian Oil Corp. Ltd., Faridabad, Haryana, India. (*www.dbtiocberc.org.in*)
Guest Faculty (Feb 2010– May 2011)	Department of Physiology, Teerthankar Mahaveer Institute of Medical Sciences, Moradabad, Uttar Pradesh, India *(http://tmu.ac.in/the-university.html)*
Assistant Professor (May 2008– Feb 2010)	Department of Physiology, Teerthankar Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh, India. *(http://tmu.ac.in/the-university.html)*
Teaching Personnel (May 2007- May 2008)	Department of Biophysics, CBSH, G.B. Pant Univ. of Ag. & Tech. Pantnagar, Uttarakhand, India. (*www.gbpuat.ac.in*)

Industrial Experience:

- Cellulolytic enzymes production in 5000L fermenters, media optimization, induction and mutagenesis
- Enzymes concentration, purification and identification based on gel electrophoresis followed by peptide sequencing etc
- Enzymes cocktail development for effective hydrolysis of lignocellulosic biomass for bioethanol production
- Enzyme recycling via. immobilization on different polymers/nanoparticles and by ultrafiltration techniques
- Enzymes cost reduction via interfering their adsorption on lignin by addition of dispersants
- Compostion analysis of different biomasses, determination of monomeric and oligomeric sugars in enzymatic hydrolysates by NREL method
- Cellulose preparation via. delignification of pretreated biomass samples and lignin preparation from different acid pretreated feedstocks
- Characterization of lignin for determining its S/G ratio, hydrophobicity etc
- Process development for simultaneous saccharification and co-fermentation (SSCF) using thermotolerant yeast
- Pretreatment of biomass in 250 Kg/day multi-feed pilot plant
- Process intensification for biomass saccharification at low enzyme dosage
- Reduction of the enzyme-lignin binding (A Patent on recipe of selected dispersants is in process)
- Lignin valorization to value added products via chemical (using acid/ alkali/ organosolv/catalyst etc.) and biochemical routes (using microbes) to PHA, lactic acid etc.
- Cellulose reforming and valorization of the residual cellulose after 2-G bioethanol process

Awards:

- Recipient of prestigious Young Scientist **Uttarakhand Governer Award- 2016** for doctoral research work by Governer, Uttarakhand at Rajbhawan, Dehradun.
- **Best poster** award for *"Second generation bioethanol production from lignocellulosic biomass employing novel thermotolerant yeast"* under*'Energy and Environment'* category by Jitendra Kumar Saini, **Ruchi Agarwal**, Reetu Saini, Alok Satlewal, Anshu Mathur, Ravi Gupta and Deepak K. Tuli (2014) in *International Conference* on *Emerging Trends In Biotechnology (ICETB 2014), 11th*

Convention of the Biotech Research Society, India (BRSI) organized by School of Environmental Sciences, Jawaharlal Nehru University, The Biotech Research Society, New Delhi, India.

- Recipient of reputed "**Innovation in Science Pursuit for Inspired Research (INSPIRE)**" **Fellowship** by **Department of Science & Technology,** Govt. of India during Ph.D. Program.
- University Merit Scholarship by Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India during Ph.D. Program.
- **First Rank Holder during Graduation & Post Graduation** studies.
- Graduate Teaching Assistantship & Fellowship by Department of Biophysics, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, UK, India during Masters Program.

Research Papers and Review Articles

1. **Ruchi Agrawal,** Alok Satlewal, Parthapratim Das, Samarthya Bhagia, Yunqiao Pu, Suresh K. Puri, SSV Ramakumar, Arthur J. Ragauskas (2019). Assessing the facile pretreatments of bagasse for efficient enzymatic conversion and their impacts on structural and chemical properties. *ACS Sustainable Chemistry & Engineering*. *7*:1, 1095–1104. **IF: 5.2**
2. **Ruchi Agrawal**, Surbhi Semwal, Ravindra Kumar, Anshu Mathur, Ravi Prakash Gupta, Deepak K. Tuli and Alok Satlewal (2018). Synergistic Enzyme Cocktail to Enhance Hydrolysis of Steam Exploded Wheat Straw at Pilot Scale. *Frontiers in Energy Research*. 6:122
3. **Ruchi Agrawal,** Bharti Bhadana, A. S. Mathur, Ravindra Kumar, Ravi P. Gupta and Alok Satlewal (2018). Improved Enzymatic Hydrolysis of Pilot Scale Pretreated Rice Straw at High Total Solids Loading. *Frontiers in Energy Research*. 6:115
4. **Ruchi Agrawal**, Alok Satlewal, Samarthya Bhagia, Joshua Sangoro, Arthur J. Ragauskas (2018) Natural deep eutectic solvents for lignocellulosic biomass pretreatment: Recent developments, challenges and novel opportunities. *Biotechnology Advances*. 36: 8, 2032-2050. **IF: 9.8**
5. **Ruchi Agrawal**, Alok Satlewal, Samarthya Bhagia, Parthapratim Das, Arthur J. Ragauskas (2018). Rice straw as a feedstock for biofuels: Availability, recalcitrance and chemical properties. *Biofuels, Bioproducts Biorefinery*. 12:1, 83- 107. **IF: 3.694, NAAS: 10.21**
6. Govind Kumar, Kavita Arya, Amit Verma, Pankaj Bhatt, Priyanka Khati, Rajesh Kumar, Anita Sharma and **Ruchi Agrawal** (2018). GC-MS Analysis of Rhizoremediation Study in Diesel Contaminated Soil Using Biosurfactants Producing Bacterial Consortium with Mustard (*Brassica Juncea* Var. Kranti) Crop. *European Journal of Sciences* (Accepted)
7. **Ruchi Agrawal,** Manali Kapoor, Sujit Mondal, Biswajit Basu, Alok Satlewal (2017). Investigating the Enzyme-Lignin Binding With Surfactants for Improved Saccharification of Pilot Scale Pretreated Wheat Straw. *Bioresource Technology* 224: 411–418. **IF: 5.744, NAAS: 11.04**
8. Manali Kapoor, Shveta Soam, **Ruchi Agrawal**, Ravi P Gupta, Deepak Tuli, Ravindra Kumar (2016). Pilot scale dilute acid pretreatment of rice straw and fermentable sugar recovery at high solid loadings. *Bioresource Technology*. 224: 688–693. **IF: 5.744, NAAS: 11.04**
9. **Ruchi Agrawal**, Alok Satlewal, Bhawna Sharma, A.S. Mathur, Ravi P. Gupta, Deepak K. Tuli, Mukund Adsul (2016). Induction of cellulases by disaccharides or their derivatives in *Penicillium janthinellum* EMS-UV-8 mutant. *Biofuels. 615-622.*10.1080/17597269.2016.1242692
10. **Ruchi Agrawal,** Anjana Srivastava, A. K. Verma (2016). Immobilization of b-glucosidase onto silicon oxide nanoparticles and augment of phenolics in sugarcane juice. *Journal of Food Science & Technology*.53 (7): 3002-3012. **IF: 2.023, NAAS: 8.20**
11. **Ruchi Agrawal**, Alok Satlewal, Ashok Verma (2015). Application of nanoparticle- immobilized thermostable β-glucosidase for improving the sugarcane juice properties. *Innovative Food Science & Emerging Technology*, 33: 472-482 **IF: 2.997, NAAS: 9.27**
12. **Ruchi Agrawal**, Alok Satlewal, Ruchi Gaur, Ravindra Kumar, A.S. Mathur, Ravi P. Gupta, Deepak K. Tuli (2015). Improved saccharification of pilot-scale acid pretreated wheat straw by

exploiting the synergistic behavior of lignocellulose degrading enzymes. *RSC Advances*, 5: 71462-71471**. IF: 3.7, NAAS: 9.84**

13. Ruchi Gaur, **Ruchi Agrawal,** Rahul Kumar, Ramu Emmandi, Ravi P. Gupta, Ravindra Kumar, Deepak K. Tuli, B P Das (2015). Evaluation of recalcitrant features impacting enzymatic saccharification of diverse agricultural residues treated by steam explosion and dilute acid. *RSC Advances*, 5: 60754-60762**. IF: 3.7, NAAS: 9.84**
14. Bhawna Sharma, **Ruchi Agrawal**, Reeta Rani Singhania, Alok Satlewal, Anshu Mathur, Deepak Tuli, Mukund Adsul (2015). Untreated wheat straw: Potential source for diverse cellulolytic enzyme secretion by *Penicillium janthinellum* EMS-UV-8 mutant. *Bioresource Technology* 196: 518-524. **IF: 5.039, NAAS: 11.04**
15. Jitendra Kumar Saini, **Ruchi Agrawal**, Alok Satlewal, Reetu Saini, Ravi Gupta, Anshu Mathur, Deepak Tuli (2015). Second generation bioethanol production at high gravity of pilot-scale pretreated wheat straw employing newly isolated thermotolerant yeast *Kluyveromyces marxianus* DBTIOC-35. *RSC Advances*, 5: 37485-37494. **IF: 3.7, NAAS: 9.84**
16. **Ruchi Agrawal**, Alok Satlewal, Ruchi Gaur, Anshu Mathur, Ravindra Kumar, Ravi Prakash Gupta, Deepak K. Tuli (2015). Pilot scale pretreatment of wheat straw and comparative evaluation of commercial enzyme preparations for biomass saccharification and fermentation. *Biochemical Engineering Journal*, 102: 54-61. **IF: 2.463, NAAS: 8.47**
17. Sandeep Sharma, Ravindra Kumar, Ruchi Gaur, **Ruchi Agrawal**, Ravi Gupta, Deepak Tuli, Biswapriya Das (2015). Pilot scale study on steam explosion and mass balance for higher sugar recovery from rice straw. *Bioresource Technology*, 175: 350-357. **IF: 5.039, NAAS: 11.04**
18. **Ruchi Agrawal**, Alok Satlewal, AK Verma (2013). Development of a β-Glucosidase hyperproducing mutant by combined chemical and UV mutagenesis. *3Biotech* (Springer), 3: 381–388. **IF: 1.00**
19. **Ruchi Agrawal**, Alok Satlewal, A.S. Mathur, Ravi P. Gupta, Tirath Raj, Ravindra Kumar, Deepak K. Tuli (2014). Kinetic and enzyme recycling studies of immobilized β-glucosidase for lignocellulosic biomass hydrolysis. *Environmental Engineering and Management Journal.* (Accepted) **IF: 1.258, NAAS: 7.07** http://omicron.ch.tuiasi.ro/EEMJ/pdfs/accepted/635_453_Agrawal_14.pdf
20. **Ruchi Agrawal**, Alok Satlewal, A.K.Verma (2013). Utilization of *Citrus sinensis* waste for the production of β-glucosidase by solid-state fermentation using a *Bacillus subtilis* mutant. *Environmental Engineering and Management Journal*, 16 **(**7): 1465-1471**. IF: 1.258, NAAS: 7.07**
21. **Ruchi Agrawal**, Alok Satlewal, AK Verma (2013). Production of an Extracellular Cellobiase in Solid State Fermentation. *Journal of Microbiology, Biotechnology and Food Sciences*, 2(4): 2339-2350.
22. Amit Verma, Hukum Singh, **Ruchi Agrawal**, Sanjeev Agrawal (2013). Alkaline protease from *Thermoactinomyces* sp. RS1 mitigates industrial pollution. *Protoplasma*, 251(3): 711-718. **IF: 3.171, NAAS: 8.65**
23. Amit Verma, Hukum Singh, **Ruchi Agrawal**, Sanjeev Agrawal (2013). Keratinase from *Thermoactinomyces* sp. RSI: An alternative to conventional chemicals for leather industry for dehairing process. *Pantnagar Journal of Research*, 11(2): 266-272**.** ISSN No. 0972-8813, **NAAS: 3.26**
24. **Ruchi Agrawal**, Alok Satlewal, Manav Chaudhary, Amit Verma, Rachna Singh, A.K. Verma, Rajesh Kumar, KP Singh (2012). Rapid detection of cadmium- resistant Plant Growth Promotory Rhizobacteria: A Perspective of ELISA and QCM- based immunosensor. *Journal of Microbiology and Biotechnology*, 22(6): 849-855. **IF: 1.685, NAAS: 7.53**
25. **R. Agrawal**, R. Singh, A. Verma, P. Panwar and A.K. Verma (2012). Partial purification and characterization of alkaline protease from *Bacillus sp.* isolated from soil. *World Journal of Agricultural Sciences*, 8 (1): 129-133.ISSN: 1817-3047.

26. M.K. Choudhary, **Ruchi Agrawal**, Rajesh Kumar, Prashant Singh, BRK Gupta, K.P. Singh (2010). Detection of cadmium resistant rhizobacteria using piezoelectric nanobiosensor. *International Journal of Nanoscience*, 9: 461. ***(Indexed in SCOPUS)***

Book Chapters

1. Harshita Negi, **Ruchi Agrawal**, Amit Verma, and Reeta Goel (2019). Municipal solid waste to Bioenergy: Current status, opportunities, and challenges in Indian context. New and Future Developments in Microbial Biotechnology and Bioengineering, Elsevier, Chapter 14. DOI: https://doi.org/10.1016/B978-0-444-64191-5.00014-6
2. Amit Verma, Satendra Kumar, Hemansi, Govind Kumar, Jitendra K. Saini, **Ruchi Agrawal**, Alok Satlewal, Mohammad W. Ansari (2018). Rhizosphere Metabolite Profiling: An Opportunity to Understand Plant-Microbe Interactions for Crop Improvement. *Crop Improvement through Microbial Biotechnology,* Elsevier (Edition 1st), Chapter 17. DOI: 10.1016/B978-0-444-63987-5.00017-7.
3. Alok Satlewal, Jitendra K Saini, **Ruchi Agrawal**, Anshu Mathur, Deepak K Tuli, Mukund Adsul (2016). Indian Biofuel Progress, GHG emission and GHG savings by biofuels: Comparative assessment with world. Book title: Sustainable Biofuels Development in India. Indian Biofuel progress, edited by Anuj K Chandel and Rajiv Sukumaran. Springer.
4. **Ruchi Agrawal**, Alok Satlewal and Ajit Varma (2014). Characterization of PGPR: A Perspective of Conventional versus Recent Techniques, *Heavy Metals Contamination of Soils, Soil Biology, Springer*. Springer International Publishing Switzerland. Edited by I. Sherameti and A. Varma (eds.), 44: 471-485. DOI: 10.1007/978-3-319-14526-6_23.

Patents

1. Ruchi Agrawal, Alok Satlewal, Ravindra Kumar, Ravi Prakash Gupta, SK Puri and SSV Ramakumar. (2018). A formulation to stabilize ligno-cellulolytic enzyme. (Filed)

2. Ruchi Agrawal, Alok Satlewal, Ravindra Kumar, Ravi Prakash Gupta, B. Basu, Deepak Tuli and Biswapriya Das. (2018). Additive composition useful for improved production of fermentable sugars from lignocellulosic biomass. Indian Patent Application (Filed in USA, Brazil, Europe, Australia and India)

Abstracts/Papers in Proceedings/ Conferences

1. **Ruchi Agrawal,** Pallavi Kumari, Alok Satlewal, Ravindra Kumar, AS Mathur, Ravi P Gupta (2018). Rice straw extractives composition and its impact on enzymes and fermentable sugars production in *9th International Symposium on Fuels and Lubricants (ISFL 2018)* held at Hotel Vivanta by Taj, Faridabad, Delhi.
2. **Ruchi Agrawal**, Alok Satlewal, Shibashish Sujit Sahoo, Anshu Mathur, Ravi Prakash Gupta and Deepak K. Tuli (2014). Pilot scale pretreatment of wheat straw and comparative evaluation of commercial enzyme preparations for biomass saccharification and fermentation in *International Conference* on *Emerging Trends In Biotechnology (ICETB 2014), 11th Convention of the Biotech Research Society, India (BRSI)* organized by Jawaharlal Nehru University, The Biotech Research Society, New Delhi, India.
3. Jitendra Kumar Saini, **Ruchi Agarwal**, Reetu Saini, Alok Satlewal, Anshu Mathur, Ravi Gupta and Deepak K. Tuli (2014). Second generation bioethanol production from lignocellulosic biomass employing indigenous thermotolerant yeast in *International Conference* on *Emerging Trends In Biotechnology (ICETB 2014), 11th Convention of the Biotech Research Society, India (BRSI)* organized by Jawaharlal Nehru University, The Biotech Research Society, New Delhi, India.

4. **Ruchi Agrawal,** Alok Satlewal, Ravindra Kumar, AS Mathur, Ravi P Gupta (2014). Application of Enzyme Immobilization for Economically Viable Bioethanol Production in *9th International Symposium on Fuels and Lubricants (ISFL 2014)* held at Hotel Vivanta by Taj, Surajkand road, NCR, Faridabad, Delhi.
5. Alok Satlewal, **Ruchi Agrawal,** AS Mathur, R P Gupta, D K Tuli, R K Malhotra (2013). Optimization of β-glucosidase immobilization in alginate beads and batch reactor studies in *3rd National Conference* on *Recent Advances in Bio-energy Research* held at Sardar Swaran Singh National Institute of Renewable Energy, Kapurthala, Punjab, India.
6. **R. Agrawal,** A. Verma, P. Panwar, A.K.Verma (2010). Partial Purification and Characterization of Alkaline Protease from *Bacillus Sp.* Isolated from Soil in *International Congress* on *"Cooling the Earth"-Tactics for Restoring Climate Order and Saving the Living Planet* held at G.B.P.U.A.T., Pantnagar.
7. **Ruchi Agrawal,** Rajesh Kumar, K.P. Singh, A.K. Verma (2010). Determination of Cd-Resistant Rhizobacteria by a Quartz Crystal Microbalance-Based Immunosensor in *5th UK State Science & Technology Congress* held at Doon University, Dehradun.
8. P. Panwar, **Agrawal R.,** A., Verma A.K., Dubey A. (2010). Assessment of Nutraceutical Values of Finger Millet and Barnyard Millet of Uttarakhand in *5th UK State Science & Technology Congress* held at Doon University, Dehradun.
9. **Ruchi Agrawal**, Manav K. Chaudhary, Deepika Kandpal, K.P. Singh (2008). Detection of Antigen using Piezoelectric Nanobiosensor in *Indo-Australian Syposium on 'Multifunctional Nanoparticles, Nanostructures and Applications'* organized by Department of Physics and Astrophysics, University of Delhi.

Workshops/ Symposium/ Conferences Attended

- *'Introduction to Bioinformatics'* (2009) held at the Biomedical Informatics Centre, Department of Biophysics, AIIMS, New Delhi.
- *'Awareness Program to Sensitize about PPV & FR Act, 2001'* (2010) by Intellectual Property Management Centre, Department of Genetics & Plant Breeding, G.B.P.U.A.&T., Pantnagar.
- *Bio-Energy Summit (2013)*, Enabling Sustainable Energy Access for India by Confederation of Indian Industry at Shangrila Hotel, New Delhi on 11th September 2013.

Professional Affiliations

- Review Editor for Bioenergy and Biofuels, Frontiers in Bioengineering and Biotechnology, Frontiers in Energy Research
- Reviewer of Critical Reviews in Microbiology, Carbohydrate Polymers, Bioresource Technology, Bioresource Technology Reports
- Life Member of AFOB (Asian Federation of Biotechnology)
- Member of 'Society of Biological Chemist' (SBC) of India (Annual)

Techniques Acquainted With

- **Microbiological Techniques:** Isolation, screening, characterization and preservation of microbial culture for repository, microscopy.
- **Molecular Biological and Biotechnological Techniques:** Genomic/plasmid DNA isolation from bacteria, plant, fungi and blood cells, Polymerase Chain Reaction (PCR), gene cloning in prokaryotic cells, strain improvement for better performance via chemical agents or UV-irradiation (mutagenesis).
- **Protein/ Enzymes Based Techniques:** Qualitative and quantitative assays for enzyme alkaline protease, endoglucanase, cellulase (filter paper unit) & β-glucosidase, submerged and solid- state fermentation, purification of enzymes (Ultrafilteration, organic solvent precipitation, ammonium sulphate precipitation, dialysis, lyophilization, column chromatography, SDS- PAGE, Native- PAGE,

Zymogram), peptide sequencing, recycling and reuse of enzymes via immobilization, characterization and kinetics of enzymes.

- **Immunological Techniques:** Antigen and antibody preparation, immunization of rabbit with antigen, animal handling, serum extraction, ELISA, antigen/antibody detection using piezoelectric biosensor or QCM (Quartz Crystal Microbalance).
- **Chromatography:** Paper Chromatography, size-exclusion chromatography, anion-exchange, chromatography, HPLC.
- **Nutritional Techniques:** Elemental analysis in plant samples, total protein, total sugar, etc.
- **Instrumentation:** Basic knowledge of the operation and handling of the 2-Dimensional Gel Electrophoresis, Lyophilizer, Ultrafilteration system, Paper, TLC, Column chromatography, HPLC, Sonicator, Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), MALDI-TOF.
- **Biomedical Techniques:** Blood pressure study using Sphagnomanometer, Electrocardiogram by ECG.
- Determination and study of Ozone concentration at different places through Ozone Analyzer.

Bioinformatics Tools/ Computer Skills

- Studied a three credit (six month) course **'Elements of Bioinformatics'** including the basics of Bioinformatics with practical applications.
- Proficient in analyzing DNA and Protein molecules on DNAMAN, DNASTAR, RASMOL, Work Bench, Primer 3, Clustal-W, FASTA, BLAST , Cn3D, Seaview, Swiss protein data base viewer, MOE, UNIX, Swiss Prot, Translation tool, Count codon, Restriction tool, NCBI.
- Proficient in MS-Office, PC Application & System Management course of 3 months (MS-DOS, Windows, MS-Word, Excel, Power Point and Internet application).
- Six months course in 'Use of Computer Software'.

Accession

- Chonsaliya R., Verma A., **Agrawal R.**, Agrawal S. (2011). Isolation, characterization and purification of alpha amylase. ACCESSION- JF521564 from GenBank for *Bacillus subtilis*.

Extra-curricular Activities

- Has been an active **Secretary of 'First Aid Committee'** of hostel in G.B.P.U.A. &T., Pantnagar.
- Has been a **Member of 'Maintenance Committee'** of hostel in G.B.P.U.A.&T., Pantnagar.
- **'Class Representative'** during Graduation.
- Participated in Personality Development Programme Certificate Course.
- Recipient of many awards in sports and athelitics (100mts. 200mts. Relay race, Table Tennis, Volley ball).
- Recipient of First Prize in Quiz Competition (2002) at Kumaon University, Nainital, Uttarakhand.
- Recipient of First Prize in Poster Competition (2002) at Kumaon University, Nainital, Uttarakhand.
- Actively participated in Drawing, Elocution, Athletics, Music and Academics at school and college level.
- Proficiency in Foreign Languages (English and German).

References

- **Dr. Ravindra Kumar** (Senior Research Manager), Department of Bioenergy, R&D Centre, Indian Oil Corporation Ltd., Faridabad, Haryana, Pin 121007, India. Email: kumarr3@indianoil.in, Ph. No. 09968246307, 0129-2294463.
- **Dr. Alok Satlewal** (Senior Research Officer), Department of Bioenergy, R&D Centre, Indian Oil Corporation Ltd., Faridabad, Haryana, Pin 121007, India. Email: satlewala@indianoil.in, alok.satlewal@gmail.com, Ph. No. 09212478797, 0129-2294713.

- **Dr. Ashok Kumar Verma** (Senior Research Officer), Department of Biochemistry, GBPUAT, Pantnagar, Uttarakhand, Pin 263145, India, E mail: akv72@rediffmail.com, Ph. No. 05944-233310, Fax: 05944-233473.
- **Dr. Rajesh Kumar** (Head of Department), Department of Environmental Microbiology, School of Environmental Sciences, Babasaheb Bhimrao Ambedkar University, Lucknow, India. Email: rajesh 4971@yahoo.com, rajesh_dem@bbau.ac.in Ph. No. 0522-2995605, +91-9412090052.

Research Summary

I am working as a **Sr. Scientific Officer** in DBT-IOC Center for Advanced Bio-Energy, IOCL. I have completed **Ph.D. in Biochemistry** with **s**pecialization in **Molecular Biology & Genetic Engineering** in 2012. I have 5 years of post Ph.D. industrial experience in the area of biofuels. My key research achievements in biofuel research are as below:

Industrial Experience

- **Pretreatment of biomass in 240 Kg/day multifeed pilot plant.** Pretreatment is carried out to make holocellulose accessible for the hydrolytic enzymes under minimal severity conditions. Structural & functional characterization of pretreated biomass is carried out by FTIR, NMR, HPLC and NREL methods.
- **Process intensification for biomass saccharification in minimum time and enzyme dosage.** We have developed a recipe where, selected dispersants **(Patent in process)** are used to improve saccharification by 30% at high solid loadings in specially designed **(20 L)** batch reactors**.**
- **In-depth understanding of the enzyme-lignin binding.** Enzyme binds non-productively with lignin. We have characterized lignin by FTIR, NMR approaches for reducing its inhibitory role in saccharification.
- **Development of an enzyme cocktail for efficient LCB saccharification.** LCB has a complex structure and multiple enzymes like cellulase xylanase, laccase, LPMOs etc. are involved in its saccharification. We have developed an optimized enzyme cocktail to achieve efficient hydrolysis of LCB.
- **Enzyme recycling for cost reduction.** Different approaches for cellulase recycling and reuse like cellulase immobilization on polymers/nanoparticles and enzyme recovery by ultrafiltration are being evaluated for cost reduction.
- **Development of simultaneous saccharification and fermentation (SSF) process.** More than 25 thermotolerant yeasts were isolated, screened and characterized from different loacations. SSF process parameters were optimized for enzyme dosage, pre-saccharification and fermentation for ethanol production at high solid loadings.

Ph.D. Research

Thesis Title: Enhanced production of β-glucosidase by chemical and UV- mutagenesis and its application after immobilization on SiO_2 nanoparticles

β-glucosidase (BGL) is a key enzyme in the production of fuel ethanol from lignocellulosic residues. But low β-glucosidase activities are usually found in commercial enzyme preparations. Hence, a BGL hyperproducing mutant was developed for process improvement as follows:

- UV and EMS mutagenesis of *Bacillus subtilis* strain for enhanced BGL production
- BGL production by Solid State Fermentation (SSF) on *Citrus sinensis* waste
- BGL purification & characterization by chromatography, gel electrophoresis, zymogram peptide sequencing etc.
- BGL immobilization on SiO_2 nanoparticles to improve stability & recycling

Recent Biofuels Publications (Total Impact factor >50 and 250 citations)

1. Alok Satlewal, **Ruchi Agrawal**, Samarthya Bhagia, Parthapratim Das, Arthur J. Ragauskas. (2018) Rice straw as a feedstock for biofuels: Availability, recalcitrance and chemical properties *Biofuels, Bioproducts Biorefinery*. 12:1, Pages 83- 107. **IF: 3.694, NAAS: 10.21**
2. Govind Kumar, Kavita Arya, Amit Verma, Pankaj Bhatt, Priyanka Khati, Rajesh Kumar, Anita Sharma and Ruchi Agrawal (2018). GC-MS Analysis of Rhizoremediation Study in Diesel Contaminated Soil Using Biosurfactants Producing Bacterial Consortium with Mustard (*Brassica Juncea* Var. Kranti) Crop. *European Journal of Sciences* (Accepted)
3. **Ruchi Agrawal,** Manali Kapoor, Sujit Mondal, Biswajit Basu, Alok Satlewal (2017). Investigating the Enzyme-Lignin Binding With Surfactants for Improved Saccharification of Pilot Scale Pretreated Wheat Straw. *Bioresource Technology* 224: 411–418. **IF: 5.744, NAAS: 11.04**
4. Manali Kapoor, Shveta Soam, **Ruchi Agrawal**, Ravi P Gupta, Deepak Tuli, Ravindra Kumar (2016). Pilot scale dilute acid pretreatment of rice straw and fermentable sugar recovery at high solid loadings. *Bioresource Technology*. 224: 688–693. **IF: 5.744, NAAS: 11.04**
5. **Ruchi Agrawal**, Alok Satlewal, Bhawna Sharma, A.S. Mathur, Ravi P. Gupta, Deepak K. Tuli, Mukund Adsul (2016). Induction of cellulases by disaccharides or their derivatives in *Penicillium janthinellum* EMS-UV-8 mutant. *Biofuels. 615-622.*10.1080/17597269.2016.1242692
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10. Bhawna Sharma, **Ruchi Agrawal**, Reeta Rani Singhania, Alok Satlewal, Anshu Mathur, Deepak Tuli, Mukund Adsul (2015). Untreated wheat straw: Potential source for diverse cellulolytic enzyme secretion by *Penicillium janthinellum* EMS-UV-8 mutant. *Bioresource Technology* 196: 518-524. **IF: 5.039, NAAS: 11.04**
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1. Alok Satlewal, **Ruchi Agrawal**, Samarthya Bhagia, Parthapratim Das, Arthur J. Ragauskas (2017). Rice straw as a feedstock for biofuels: Availability, recalcitrance and chemical properties. *Biofuels, Bioproducts & Biorefining*, DOI: 10.1002/bbb.1818

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3. **Ruchi Agrawal**, Alok Satlewal and Ajit Varma (2014). Characterization of PGPR: A Perspective of Conventional versus Recent Techniques, *Heavy Metals Contamination of Soils, Soil Biology, Springer*. Springer International Publishing Switzerland. Edited by I. Sherameti and A. Varma (eds.), 44: 471-485. DOI: 10.1007/978-3-319-14526-6_23. (www.springeronline.com/series)

Patents

1. Ruchi Agrawal, Alok Satlewal, Ravindra Kumar, Ravi Prakash Gupta, SK Puri and SSV Ramakumar. (2018). A formulation to stabilize ligno-cellulolytic enzyme mixture. (In Filing Process)

2. Ruchi Agrawal, Alok Satlewal, Ravindra Kumar, Ravi Prakash Gupta, B. Basu, Deepak Tuli and Biswapriya Das. (2018). Process for improved biomass hydrolysis at low enzyme loadings. Indian Patent Application (In Filing Process)

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गोविन्द बल्लभ पंत कृषि एवं प्रौद्योगिक विश्वविद्यालय

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विद्वत् परिषद् की संस्तुति पर

कु० रुचि अग्रवाल ना0सं0 32788
जिन्होंने **मास्टर ऑफ साइन्स की उपाधि** हेतु निर्धारित पाठ्यक्रम **जुलाई, 2007**
में पूरा किया, को उक्त उपाधि आज दिनांक **16 अप्रैल, 2008** को प्रदान की गयी।
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