INDIAN INSTITUTE OF TECHNOLOGY DELHI
DEPARTMENT OF BIOCHEMICAL ENGINEERING & BIOTECHNOLOGY
2019-20 Seminar Series

Wednesday, 24th April, 2019

Dr. Guneet Kaur
Assistant Professor
Hong Kong Baptist University, Hong Kong

Title: Closed Loop (Bio)economy From waste to wealth by biorefinery approach

The concept of circular economy was launched in 2010. Design and adoption of circular economy approaches which account for sourcing, production, consumption, disposal and reuse or recycling of resources is needed to fulfil the criteria of sustainable development. The biorefinery concept has been envisaged to drive the transition from the current linear economy (extract-process-consumption-disposal) to a closed loop economy for maintaining the value of products, materials and resources in the economy for as long as practically possible. In this regard, bio-based sourcing of high value-added products from non-food and/or waste feedstocks has attracted a great deal of attention in the biorefinery production model. While this aspect allows renewability of products, other important factors such as development of robust production schemes, increased market opportunities, public acceptance of bio-based and/or waste-derived products and initiatives, policies and regulations from government and private institutions play an important role in promotion and successful development of a circular economy. In this talk, I will present these aspects of a closed-loop biorefinery using case studies of a Food waste and Textile waste-based biorefinery for production of valuable products including sugar feedstock, recycled fibre, and biosurfactant.

All are welcome

Seminar will be held in DBEB Seminar room at Block I, Room 223 at 4 pm
For additional information, contact Seminar coordinator Dr. Preeti Srivastava at preeti@dbeb.iitd.ac.in or Dr. D. Sundar at sundar@dbeb.iitd.ac.in

Guneet Kaur, Ph.D.

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EDUCATION

Ph.D. Biochemical Engineering and Biotechnology, Indian Institute of Technology Delhi (IIT Delhi), New Delhi, India	2009-13
M.Sc. Applied Genetics, Garden City College, Bangalore University, Bangalore, India	2006-08
B.Sc. Zoology (Honours), Sri Venkateswara College, University of Delhi, New Delhi, India	2003-06

RESEARCH & TEACHING INTERESTS

Biochemical Engineering	Molecular microbiology	*In-situ* product recovery
Waste Valorization	Environmental Biotechnology	Bioprocess Design and Optimization

RESEARCH EXPERIENCE

Department of Biology, Hong Kong Baptist University, Hong Kong

Assistant Professor 2018 -

Research Assistant Professor 2017- 2018

- Developing food waste-based biorefinery for multiple product formation
- Developing strategies for food waste and sludge anaerobic co-digestion for improved methane production and bio-products recovery

City University of Hong Kong, Hong Kong

Research Fellow, School of Energy and Environment 2015-17

Responsible for delivery of key project objectives in Innovation and Technology Fund (ITF), Government of Hong Kong, project to develop valorization processes for conversion of solid wastes into high-value added products

Textile waste recycling by biological method (co-sponsored by H&M, Sweden)

- Developed the method for high production of cellulase using textile waste as substrate in fungal fermentation
- Demonstrated high enzymatic hydrolysis efficiency of produced cellulase leading to >40% sugar recovery from textile waste for use in subsequent bioconversions

Food waste valorization into biosurfactant

- Developed the production protocol to convert food waste nutrients into biosurfactant in bioreactor

Postdoctoral Fellow, Department of Biomedical Sciences

Lead researcher in ITF project on *Recombinant Small Interfering RNAs (siRNAs) as potent and cost-effective RNAi therapeutics using microbial cell factories*

- Engineered pro-siRNA biogenesis determinants including abundance of p19 protein, double-stranded RNA production method, RNase III overexpression in *E. coli* to obtain a pro-siRNA yield enhancement to ten milligrams per litre scale (200-fold increase) in bioreactor
- Optimized fermentation process through fed-batch strategies to maximize production performance in bench scale (up to 7 L) bioreactor
- Improved chromatography steps through resin performance evaluation and elution conditions to remove long contaminating RNA from siRNA and enhance its purity for therapeutic applications
- Established a high knockdown efficiency of >90% of produced pro-siRNAs *in-vitro*

University of Westminster, London, United Kingdom

Research Fellow, Department of Life Sciences 2014-15

Responsible for Biomaterials Process Development in *FP7 EU project- ReBioStent for Development of Bioresorbable Biomaterials for Therapeutic Drug Eluting Cardiovascular Stents*

- Optimized Polyhydroxyalkanoate (PHA) production by bacteria using pure and non-carbon

related, and inexpensive carbon sources in bench-scale and up to 20 L bioreactor
- Led the analysis and interpretation of biopolymer fermentation data to identify critical issues in process improvement leading to design of fed-batch processes for improved PHA yields

Flemish Institute for Technological Research (VITO), Mol, Belgium
Visiting Postdoctoral Scientist, Separation and Conversion Technology Unit 2013-14
Research activities in *FP 7 EU Project- BioConSepT to develop In-Situ Product Recovery (ISPR) technologies for organic acids from fermentation processes*
- Designed ISPR process for itaconic acid based on reactive extraction, back extraction and solvent related microbial toxicity
- Performed conceptual design of production chains for itaconic acid and techno-economic analysis

IIT Delhi, New Delhi, India
Doctoral Fellow, Department of Biochemical Engineering and Biotechnology 2009-13
Thesis: Studies on the bioconversion of renewable feedstock to 1,3-Propanediol
Thesis Advisors: Prof. Ashok K Srivastava, Prof. Subhash Chand
- Obtained batch kinetics and inhibition data (substrate/product) in the bioconversion of glycerol to 1,3-Propanediol (1,3-PD) using *Clostridium diolis* to develop a mathematical model describing process behavior
- Designed and implemented fed-batch/high cell density continuous bioreactor operating strategies for mass scale production of 1,3-PD using the developed model
- Developed an integrated continuous cultivation-extraction system and obtained a 5-fold improvement in 1,3-PD productivity over batch fermentation

TEACHING EXPERIENCE

Department of Biology, Hong Kong Baptist University, Hong Kong 2017-
Course(s) title: Environmental Biotechnology, Waste Treatment and Recycling
(Applied Biology Environmental Science and Biotechnology 3rd/4th year undergraduates)

Department of Biomedical Sciences, City University of Hong Kong, Hong Kong 2015-16
Tutor, Course title: Microbial Physiology (to Dr. Linfeng Huang, Dr. Youngjin Lee; One semester)
- Designed course experiments for lab class and conducted tutorial classes for undergraduates

Department of Life Sciences, University of Westminster, London, United Kingdom 2014-15
Postgraduate Project Co-ordinator
- Designed and supervised final year postgraduate projects on biopolymer production

Groep-T, Internationale Hogeschool Leuven, Belgium 2013-14
Co-Supervisor to a Masters (MS) candidate, Thesis: Back extraction protocols for recovery of itaconic acid

IIT Delhi, New Delhi, India 2010-12
Teaching Assistant, Course title: Modelling and Optimization of Bioprocesses (to Prof. Ashok K Srivastava; Two semesters)
Teaching Assistant, Course title: Enzyme Engineering and Technology (to Prof. Subhash Chand; One semester)

FELLOWSHIPS AND SCHOLARSHIPS

1. **FRQNT (Fonds de recherche du Quebec - Nature et technologies) Postdoctoral Merit Fellowship, Canada** – 2nd Rank (Proposal Score- 18.4/20), Granted by Ministère de l'Éducation, du Loisir et du Sport du Québec, Canada to conduct research on biobutanol at Institut national de la recherche scientifique (INRS), Canada (2014) (Fellowship declined)
2. **Senior Research Fellowship** – Indian Council of Medical Research (ICMR), Government of India (2010)

3. **Junior Research Fellowship** – Indian Council of Medical Research (ICMR), Government of India (2008)
4. **Merit scholarship** (**awarded to top 5% students** of each Honours course) – University of Delhi, India (2004)

HONOURS AND AWARDS

1. **Best Poster Award –** 2nd International Conference on Bioresource Technology for Bioenergy, Bioproducts and Environmental Sustainability (Biorestec 2018), Sitges, Spain *(Bioresource Technology Journal, Elsevier)*.
2. **Gold Medal (evaluated amongst 800 entries) –** Awarded by Jury at 46th International Exhibition of Inventions of Geneva, Switzerland, for achievements on project 'Textile waste recycling by biological method' (2018)
3. **Best Poster Award (First Prize) –** Research Gala, Department of Biomedical Sciences, City University of Hong Kong, Hong Kong (Prize HK$5000) (2016)
4. **Best Industry Relevant PhD project Nomination** – Foundation for Innovation and Technology Transfer (FITT), IIT Delhi, India (2014)
5. **Top Cited Article Award** – Awarded by Biochemical Engineering Journal (Elsevier) for the article 'Advances in biotechnological production of 1,3-propanediol' (2014)
6. **Amit Garg Memorial Research Award Nomination**, IIT Delhi, India – Awarded to one PhD candidate from entire institute having publications in high impact factor journals (2013)
7. **International Travel Grant** – DST, CSIR, DBT, Government of India for Oral presentation at 15th European Congress on Biotechnology (ECB'15), Istanbul (2012)
8. **Best Oral Presentation Award** – National Science Day, Ministry of Science and Technology, Government of India and IIT Delhi (2012) (Cash prize INR 5000)
9. **Best Poster Award** – International Conference on Microbial Technology for Sustainable Development, Association of Microbiologists of India (2011) (Cash prize INR 1000)
10. **Ranked 3rd (in a batch of 250+ students) in Masters** in Bangalore University, India (2008)
11. **Cream of Garden City College Award** (**for securing University rank**) – Bangalore University, India (2008)
12. **Mrs. P. Gupta Meritorious Award for top scoring in Entomology** (specialization in Final year Undergraduate course) – Sri Venkateswara College, University of Delhi, India (2006)

GRANTS

1. Innovation and Technology Commission, Government of Hong Kong (ITF). Integration of next-generation rhamnolipid production into anaerobic digestion: New prospects for advanced biorefineries (ITS/176/18). Total grant: HK$1,271,900 December 2018 – May 2020 (PI)
2. Environment and Conservation Fund, Government of Hong Kong (ECF). Enhancing the organic loading efficiency in co-digestion of food waste and sludge via manipulation of microbial interactions. ECF Project 108/2018. Total grant: HK$1,160,220 May 2019 – Oct 2020 (PI)
3. Start-up Grant, Hong Kong Baptist University. Total grant: HK$500,000

PUBLICATIONS, PAPERS & PATENTS

PEER-REVIEWED JOURNAL PUBLICATIONS *(h – index: 11; i10 index: 11, obtained from Google Scholar)*

1. **Guneet Kaur**, Hung-chi Cheung, Wei Xua, Jun Vic Wong, For Fan Chan, Yingxue Li, Larry McReynolds, Linfeng Huang. Milligram scale production of potent recombinant small interfering RNAs in *Escherichia coli*. Biotechnology and Bioengineering (2018) DOI 10.1002/bit.26740 **(*IF: 4.481*)**
2. **Guneet Kaur***, Miranda Maesen, Linsey Garcia-Gonzalez, Heleen De Wever, Kathy Elst*. Novel intensified back extraction process for Itaconic Acid – toward in Situ product recovery for Itaconic acid fermentation. ACS Sustainable Chemistry & Engineering 6 (2018) 7403-7411 **(*IF: 6.140*)** **Corresponding author*
3. Jonathan WC Wong, **Guneet Kaur**, Sanjeet Mehariya, Obulisamy Parthiba Karthikeyan, Guanghao Chen. Food waste treatment by anaerobic co-digestion with saline sludge and its implications for energy recovery in Hong Kong. Bioresource Technology 268 (2018) 824-828 ***(IF: 5.651)***

4. Huaimin Wang, **Guneet Kaur**, Nattha Pensupa, Kristiadi Uisan, Carol Sze Ki Lin. Textile waste utilization by using submerged filamentous fungal fermentation. Process Safety and Environmental Protection 118 (2018) 143-151 ***(IF: 3.441)***
5. **Guneet Kaur**, Kristiadi Uisan, Khai Lun Ong, Carol Sze Ki Lin. Recent Trends in Green and Sustainable Chemistry & Waste Valorisation: Rethinking Plastics in a Circular Economy. Current Opinion in Green and Sustainable Chemistry 9 (2018) 30-39 (*Selected for Media coverage in Elsevier Chemistry-* https://www.elsevier.com/physical-sciences/chemistry/new-chemistry-research/plastics-in-the-circular-economy) *(Top downloaded article March-May 2018)*
6. Khai Lun Ong[1], **Guneet Kaur[1]**, Nattha Pensupa, Kristiadi Uisan, Carol Sze Ki Lin. Trends in food waste valorization for the production of chemicals, materials and fuels: Case study South and Southeast Asia. Bioresource Technology 248 (2018) 100-112 **(*IF: 5.651*)** *[1]Co-first authors*
7. Hualin Li, Peng Liu, **Guneet Kaur**, Xi Yao, Mengsu Yang. Transparent and Gas-Permeable Liquid Marbles for Culturing and Drug Sensitivity Test of Tumor Spheroids. Advanced Healthcare Materials 6 (2017) 1700185 **(*IF: 5.760*)** *(Highlighted on news website Advanced Science News)*
8. **Guneet Kaur**, A K Srivastava, Subhash Chand. Debottlenecking product inhibition in 1,3-Propanediol fermentation by *In-Situ* Product Recovery (ISPR). Bioresource Technology 197 (2015) 451-57 **(*IF: 5.651*)**
9. **Guneet Kaur**, Ipsita Roy. Strategies for large scale production of Polyhydroxyalkanoates. Chemical and Biochemical Engineering Quarterly 29 (2015) 157-72 **(*IF: 1.383*)** *(Invited Review)*
10. **Guneet Kaur**, Kathy Elst. Development of reactive extraction systems for itaconic acid fermentation: A step towards ISPR of itaconic acid. RSC Advances 4 (2014) 45029- 45039 **(*IF: 3.108*)**
11. Wouter Van Hecke[1], **Guneet Kaur[1]**, Heleen De Wever. Advances in In-Situ Product Recovery (ISPR) in whole cell biotechnology during the last decade. Biotechnology Advances 32 (2014) 1245-55 **(*IF: 10.597*)** *[1]Co-first authors*
12. **Guneet Kaur**, Ashok K Srivastava, Subhash Chand. Biotechnological valorization of glycerol to 1,3-propanediol: A mathematical model-based nutrient feeding approach for high production using *Clostridium diolis*. Bioresource Technology 142 (2013) 82-87 **(*IF: 5.651*)**
13. **Guneet Kaur**, Ashok K Srivastava, Subhash Chand. Mathematical modelling approach for concentration and productivity enhancement of 1,3-propanediol. Biochemical Engineering Journal 68 (2012) 34-41 **(*IF: 2.892*)**
14. **Guneet Kaur**, A K Srivastava, Subhash Chand; Advances in Biotechnological production of 1,3-propanediol. Biochemical Engineering Journal 64 (2012) 106– 118 **(*IF: 2.892*)** *(Top Cited Paper for 2011 and 2012)*
15. **Guneet Kaur**, Ashok K Srivastava, Subhash Chand. Determination of kinetic parameters of 1,3-propanediol fermentation using statistically optimized medium. Bioprocess and Biosystems Engineering 35 (2012) 1147-1156 **(*IF: 1.870*)**
16. **Guneet Kaur**, Ashok K Srivastava, Subhash Chand. Simple Strategy of Repeated Batch Cultivation for Enhanced Production of 1,3-Propanediol using *Clostridium diolis*. Applied Biochemistry and Biotechnology 167 (2012) 1061-1068 **(*IF: 1.751*)**
17. **Guneet Kaur**, Ruchira Sharma, Ashok K Srivastava, Subhash Chand. On-line characterization of metabolic state in batch cultivation of *Clostridium diolis* for 1,3-propanediol production using $NADH+H^+$ fluorescence. Applied Biochemistry and Biotechnology 166 (2012) 138-145 **(*IF: 1.751*)**

Publications under review/ preparation

1. **Guneet Kaur**, Huaimin Wang, Carol Sze Ki Lin. High production of biosurfactant using food waste (Under review)
2. **Guneet Kaur**, Liwen Luo, Jonathan WC Wong. Novel integrated wastewater and food waste treatment technology and its application for enhanced methane production by anaerobic digestion (Under preparation)

PATENTS

1. Small-interfering RNA expression systems for production of small-interfering RNAs and their use. US Patent Publication No. 15/351,768 (2016) (Patent Pending)

BOOKS

1. Carol Sze Ki Lin, **Guneet Kaur**, Chong Li, Xiaofeng Yang (Eds.). Waste Valorisation: Rethinking Waste streams in a Circular Economy. Wiley Publishing (Release Aug 2019).

BOOK CHAPTERS

1. Sujata Sinha, **Guneet Kaur***. Molecular imprinted polymer-based biosensors for detection of pharmaceutical

contaminants in the environment. Elsevier (accepted) (2019) **Corresponding author*

2. **Guneet Kaur**. Non-refined carbon sources and microbial performance. In Microbial Sensing in Fermentation, Eds. Satinder K. Brar, Ratul K. Das, Saurabh J. Sarma, John Wiley & Sons, Ltd.,pp 43-59.
3. Kristiadi Uisan, Jonathan WC Wong, **Guneet Kaur***. Bio-products from food waste. Elsevier (submitted) (2019) **Corresponding author*

INVITED TALKS & PRESENTATIONS

1. Delivered a guest lecture on "Valorization of waste to produce value-added products" at School of Energy and Environment, City University of Hong Kong, Hong Kong (2017)
2. Delivered an invited talk on "Being creative with Reactors: Novel Fermentation Processes" at Society of Industrial Chemistry (SCI), London, United Kingdom (2014) (http://www.soci.org/news/biotechnology/agm-2014)
3. Gave a talk on "Bioengineering and its applications in production of bio-based products" at School of Energy and Environment, City University of Hong Kong, Hong Kong (2014)
4. Delivered a lecture on "Modelling as a tool for Optimization of Bioprocesses" at School of Life Sciences, Jawaharlal Nehru University, New Delhi, India (2013)

CONFERENCE PRESENTATIONS

1. **Guneet Kaur**, Jonathan Wong. 2nd International Conference Bioresource Technology for Bioenergy, Bioproducts & Environmental Sustainability, Sitges, Spain, 16-19th Sep 2018 (Oral & Poster Presentation)
2. **Guneet Kaur[1]**, Tsz Him Kwan[1], Yunzi Hu, Hei Yan Lee, Tsz Chung Chan, Wing Hei Kwan, Chun Yin Yap, Carol Sze Ki Lin; The 2nd International Conference on Biological Waste as Resource, The Hong Kong Polytechnic University, Hong Kong, 25-28th May 2017 (Oral Presentation) *[1]Co-first authors*
3. **Guneet Kaur**, Linfeng Huang; Regulatory and Non-coding RNAs, Cold Spring Harbor Laboratory, United States of America, New York, 23-27th Aug 2016 (Poster Presentation)
4. **Guneet Kaur**, Linfeng Huang; Research Gala, Department of Biomedical Sciences, City University of Hong Kong, Hong Kong, 20th Jun 2016 (Poster Presentation)
5. **Guneet Kaur**, Ashok K Srivastava, Subhash Chand; 15th European Congress on Biotechnology (ECB'15), Istanbul, Turkey, 23-26th Sept 2012 (Oral presentation)
6. **Guneet Kaur**, Ashok K Srivastava, Subhash Chand; Selected (selected from ~50 invited entries from the entire Institute) for Presentation on National Science Day, IIT Delhi organized by Ministry of Science and Technology, Government of India and IIT Delhi, India, 28th Feb 2012 (Oral Presentation)
7. **Guneet Kaur**, Ashok K Srivastava, Subhash Chand; International Conference on New Horizons in Biotechnology, Trivandrum, India, 21-24th Nov 2011 (Poster Presentation)
8. **Guneet Kaur**, Ashok K Srivastava, Subhash Chand; International Conference on Microbial Technology for Sustainable Development, AMI, Chandigarh, India, 3-6th Nov 2011 (Poster presentation)
9. **Guneet Kaur**, Ashok K Srivastava, Subhash Chand; World Congress on Biotechnology (OMICS Publishing Group Conferences), Hyderabad, India, 21-23rd Mar 2011 (Poster presentation)

COMMUNITY SERVICE

Editorial Board Member

- Journal of Food and Industrial Microbiology (2015 – Present)

Reviewer/Evaluator

- Environmental Research, Technology Demonstration and Conference (RTDC) Projects Funding Scheme of the Environment and Conservation Fund (ECF), Government of Hong Kong (2019)
- Hong Kong Council for Accreditation of Academic and Vocational Qualifications, Hong Kong (2019)

Conference Organizer

Organizing Committee Member, International Conference on Sustainable Biowaste Management (SBM 2020), 4th - 6th

May 2020, Hong Kong Baptist University, Hong Kong

Journal and Conference Abstract Reviewer

- Process Safety and Environmental Protection
- Journal of Bioscience and Bioengineering
- Biomass and Bioenergy
- Electronic Journal of Biotechnology
- Journal of Bioprocess and Biosystems Engineering
- Bioresource Technology
- Biotechnology Progress
- Journal of Toxicology
- The 3rd International Conference on Biomedical Engineering and Biotechnology (ICBEB 2014), Beijing, China

REFERENCES

1. Dr. Carol Lin, Associate Professor, School of Energy and Environment, City University of Hong Kong, 83 Tat Chee Avenue, Kowloon Tong, Hong Kong. Email: carollin@cityu.edu.hk, Fax: +852-34420688
2. Dr. (Ir.) Kathy Elst, Project Manager, Separation and Conversion Technology, Flemish Institute for Technological Research (VITO), Boeretang 200, 2400 Mol, Belgium. E-mail: kathy.elst@vito.be. Tel.: +32-1433 5617
3. Dr. Satinder Kaur Brar, Professor, Institut national de la recherche scientifique (INRS), Centre - Eau Terre Environnement/Centre for Water, Earth and Environment, 490 de la Couronne, Québec, G1K 9A9 Canada, Email: satinder.brar@ete.inrs.ca. Fax: +418-6542600
4. Dr. Ashok K. Srivastava, Professor, Department of Biochemical Engineering and Biotechnology, Indian Institute of Technology Delhi, Hauz Khas, New Delhi, 110016, India. E-mail: ashokks@dbeb.iitd.ac.in. Tel.: +91-26591010