Prof. Dr. NG Wun Jern

Professor - President's Chair in Civil & Environmental Engineering
School of Civil & Environmental Engineering
Nanyang Technological University, Singapore

Principal Lead - Environmental Bio-innovations Group (EBiG)

Distinguished Professor
Faculty of Engineering and Built Environment, UKM

Scientific Advisor - Ministry of Sustainability and the Environment,
Member, Committee of Government Scientific Advisors

Biodata

NG Wun Jern is a Professor at the Nanyang Technological University, Singapore (NTU), School of Civil & Environmental Engineering, and Principal Lead at the Environmental Bio-innovations Group (EBiG- https://personal.ntu.edu.sg/wjng). His research and development interests lie in the areas of water, wastewater, and waste management, as well as agriculture media remediation and enhancement.

NG had been Dean of Engineering at the National University of Singapore and Nanyang Technological University. He founded and led the Nanyang Environment & Water Research Institute (NEWRI) to its global recognition as among the best before retiring after 10 years at the helm. Aside from being well published, he has experience in translation, and technology development, and, as a licensed engineer, in plant engineering and project implementation at full-scale. His research outcomes have been used in 130 instances of design and construction of full-scale wastewater treatment and resource recovery facilities. His work experience spans the Middle East, South Asia, ASEAN, and East Asia. NG regularly provides technical advice to companies (public listed and SMEs) and government agencies in the water, wastewater, and waste management domains. He also supports private equity funds and accelerators in project assessments, and in selecting and guiding start-ups. NG's contributions to academia and industry have been recognized with numerous awards.

Abstract

Wastewater Management – A Discussion on Drivers of Technology Change

This presentation discusses the need for a R&D supplier (such as the presenter) to know what drives technology development in the wastewater management domain and how such technology development is tied to scientific understanding without which the R&D shall unlikely result in an appropriate response to these drivers. The appropriate response then results in technologies which make appearance in the marketplace. Four drivers are identified and used to illustrate the discussion. These are discharge limits, space constraints, costs constraints, and growing sustainability consciousness. Response to the space constraint can be made by changing the reactor flow regime. The latter in turn changes the substrate concentration profiles and hence modifies microbial kinetics. In addition to the latter, system kinetics can be intensified by changing population size and the latter can be influenced by how microbial populations are assembled – ie morphology. This has then given rise to the biofilm and granular sludge systems. These larger populations may also offer better protection against inhibition episodes. The growing number and variety of industrial wastewaters have increased risk of such inhibition and consequent process failure. The complexity (or ironically at times simplicity) of industrial wastewaters requires understanding of acclimation, degradation pathways, and, increasingly, selection and population supplementation. To better respond to adverse conditions, microbes do communicate and such quorum sensing allows for community action. The signaling compounds involved in such communication have led to work on bioactives and their application, as a recovered material and using biochar recovered from sludge as a carrier. Resource recovery is an expanding interest given the growing consciousness in the need for sustainability. Application of the biactives on biochar can be a move towards more sustainable agriculture.

Prof. Ir. Dr. Siti Rozaimah Sheikh Abdullah

Professor
Department of Chemical and Process Engineering,
Faculty of Engineering and Built Environment, UKM

Deputy Dean (Undergraduate)
Faculty of Engineering and Built Environment, UKM

Biodata

Siti Rozaimah Sheikh Abdullah is a Professor in the Department of Chemical and Process Engineering, Faculty of Engineering, UKM. She was appointed as the Head of Department of Chemical and Process Engineering, Faculty of Engineering and Built Environment, UKM in 2014 –2017 and Chemical Engineering Programme, Faculty of Engineering and Built Environment, UKM in 2018 – 2019. She is currently serving as Deputy Dean (Undergraduate), Faculty of Engineering and Built Environment, UKM.

In terms of professional memberships, Siti Rozaimah is a member of the International Water Association (IWA), IChemE, U.K. (Assoc. Member), and the Board of Engineers, Malaysia (PEng C115033). Her research specialization includes waste and wastewater treatment system, phytoremediation, waste audit and management, waste recovery and minimization, artificial intelligence-based control (fuzzy logic, neural network) in wastewater treatment. She has led more than 20 research projects since 1997 related to her field of expertise. Besides, she has involved in consultation projects with Group Technical Solution (GTS) - Petronas, Malaysia Newsprint Industry Sdn. Bhd., Central Utility Facilities (CUF) Sdn. Bhd., ECERDC: P010/033, Institut Alam Sekitar Malaysia (EiMAS), and Petronas Penapisan (Terengganu) Sdn. Bhd.

Siti Rozaimah's contributions to academia have been recognized with numerous awards including Anugerah Penyelidik Cemerlang FKAB 2014 & 2016, MTSF Science and Technology Award 2015 for outstanding achievements in the field of Nanofiltration and Ultrafiltration Technologies for Water and Wastewater Treatment, Gold Medal Award in Innovative Practices in Higher Education Expo 2014 (i-PHEX 2014), Bronze medal in 32 International Exhibition of Inventions of Geneva, New Techniques And Products of Geneva 2004, Geneva, Switzerland for a research project "A Low Cost Vision Based Sensor for Online Monitoring and Control In Wastewater Treatment Process", among others.

Abstract

Phytotechnology as Green Solution for Waste: How Does It Work?

Requirement and necessity of modern life has tremendously and indirectly increased product processing and industrialization. Numerous types of industries have been developed to fulfill the human demands. Most of product processing industries utilize energy, raw materials, chemicals, and water in their operation, leading to discharge of large amount of waste in solid form, wastewater or effluent and even gaseous pollutants to the environment. Depending on the type of industries, majority of industry effluent contains toxic chemicals, nutrients, suspended solid, organic carbon and inorganic constituents which will give detrimental impacts on the environment, health and safety. Industrial wastewater containing all these components need to be properly treated before can be safely discharged to the environment. Technology of waste and wastewater treatment has since developed by researchers and industries to minimize the impact on the environment and human. Fundamentally, it consists of physical, chemical and biological treatment, and advanced treatment. Phytotechnology is an environmentally friendly approach for waste/wastewater treatment that makes use of plants and its associated microbes to extract, degrade, transform, filter, accumulate or detoxify pollutants. It is an established treatment method and widely adopted in developed countries like U.S., Europe, Japan and China. Although Malaysia is a tropical country with sunlight throughout the year and is rich with flora, the application of this technology is still limited and not well known, and still at research stage. Thus, this webinar will unveil the secret of this technology so that it can be exploited by industries, municipal councils or any government/private sectors as a green solution for waste in the form of solid, liquid or gas.

Prof. Dato' Ir. Dr. Abdul Wahab Mohammad

Professor
Department of Chemical and Process Engineering,
Faculty of Engineering and Built Environment, UKM

Deputy Vice Chancellor (Research and Innovation Affairs), UKM

Biodata

Dato' Abdul Wahab is currently Professor in Membrane and Separation Technology at the Department of Chemical and Process Engineering, Universiti Kebangsaan Malaysia (UKM). He was previously the Dean of the Faculty of Engineering and Built Environment, UKM. Between March and July 2018, he was seconded as Research Director for Water Research at Qatar Energy and Environment Research Institute (QEERI) in Doha, Qatar. He was the co-recipient of 2008 Prince Sultan International Water Prize for his work on nanofiltration membranes and 2015 MTSF Science Award. Dato' Abdul Wahab is a registered Professional Engineer (PEng) in Malaysia and a Chartered Engineer (CEng) in United Kingdom. He is also a Fellow of IChemE and as well as a Fellow of the Academy of Sciences Malaysia.

His research interest is on membranes science and applications, nanoparticles, wastewater treatment, water reuse and recycling, sustainable separation technology and engineering education. He has published more than 300 journal papers with citation exceeding 10000 and h-index of 48. He is the Chief co-editor of the Journal of Water Process Engineering, which was launched in 2014 and recently received an impact factor of 3.465. He is the co-editor of an Elsevier journal, Journal of Water Process Engineering which recently received an impact factor of 3.173.

Abstract

Physical-chemical Treatment of Water and Wastewater

The importance of water in this era of sustainable development cannot be denied. Various technologies have been proposed for treatment of water and wastewater treatment. Physical-chemical treatment methods have been acknowledged as among the most important methods that have found wide applications in many industries. These methods include coagulation/flocculation, conventional filtration, membrane-based processes, adsorption-based processes, as well as advanced oxidation processes. The talk will provide an overview of these methods and perspectives on the future development of these methods.

Prof. Dr. Ranil Wickramasinghe

Professor
Ralph Martin Department of Chemical Engineering
University of Arkansas, United States of America

Distinguished Professor
Faculty of Engineering and Built Environment, UKM

Biodata

Ranil Wickramasinghe is a Distinguished Professor in the Department of Chemical Engineering at the University of Arkansas where he holds the Ross E Martin Chair in Emerging Technologies. He is an Arkansas Research Alliance Scholar and Director. He is the Director of the Membrane Science, Engineering and Technology (MAST) Center, a National Science Foundation Industry-University Cooperative Research Center. Prof Wickramasinghe is the Executive Editor of Separation Science and Technology. He worked for 5 years in the biotechnology/biomedical industry in the Boston area before joining the Department of Chemical Engineering at Colorado State University. He joined the Department of Chemical Engineering at the University of Arkansas in 2011. Prof. Wickramasinghe has published over 200 peer reviewed journal articles, several book chapters and patents and is co-editor of a book on responsive membrane and materials. He is active in the American Institute of Chemical Engineers and was the Meeting Co-Chair for the 2017 International Congress on Membranes and Membrane Processes in San Francisco. He also serves on the Board of Directors of the North American Membrane Society. Prof. Wickramasinghe's research focuses on synthetic membrane-based separation processes for purification of pharmaceuticals and biopharmaceuticals, treatment and reuse of water and for the production of biofuels. A current research focus is surface modification of membranes in order to impart unique surface properties. His group is actively developing responsive membranes such as the development of catalytic membranes for biomass hydrolysis by grafting catalytic groups to the membrane surface. He helped cofound Siev Technologies, which is focused on commercializing the catalytic membrane technology developed by Prof. Wickramasinghe's group.

Abstract

Process Intensification in Integrated Use of Water and Wastewater Treatment Technologies

Membrane based separations are attractive for water and wastewater treatment. Unit operations such as reverse osmosis and submerged membranes in membrane bioreactors, are routinely found in treatment facilities. Membrane based unit operations are environmentally friendly, easily scaled up, have a small footprint and generally have low operating costs. Further unit operations such as submerged membranes in membrane bioreactors offer significant process intensification compared to conventional activated sludge processes. However, membrane fouling is a major impediment which limits the viability of membrane based unit operations. Consequently, integration of a membrane based unit operation with appropriate feed pretreatment is critical to minimize membrane fouling. In addition, development of advanced fouling resistant membranes is essential. In this presentation the use of electrocoagulation as a feed pretreatment operation prior to reverse osmosis for brackish water treatment will be discussed. As a second example the feasibility of using electrocoagulation prior to forward osmosis and membrane distillation will be described. The advantages of an integrated electrocoagulation, ultrafiltration and membrane distillation process for maximizing water recovery from hydraulic fracturing produced water will further highlight the potential for process intensification through integrated membrane based separation processes. While these examples highlight the importance of developing integrated membrane based separation processes to minimize membrane fouling and maximize water recovery the need to develop advanced fouling resistant membranes persists. For example, a major challenge that limits the viability of membrane distillation is fouling and wetting of the membrane. Membrane fouling can lead to a significant decline in the permeate flux while wetting leads to passage of water rather than the water vapour through the membrane pores. Novel bilayer electrospun membranes that are fouling and wetting resistant will be described. We show that tuning the surface properties of the membrane surface that faces the feed and permeate streams is essential to increase the resistance to fouling and wetting of the membrane. Not only are these membranes more stable they could also reduce the pretreatment requirements.

Prof. Ir. Dr. Mohd Sobri Takriff

Professor
Department of Chemical and Process Engineering,
Faculty of Engineering and Built Environment, UKM

Director of UKM IDEA Center, UKM

Biodata

Professor Mohd Sobri Takriff is the Director of UKM IDEA Center, a research strategic office for Universiti Kebangsaan Malaysia. He is currently leading a University-Industry collaborative initiative for the development of zero waste processing practices for the palm oil industry. This initiative is funded by the Sime Darby Foundation, Sime Darby plantation as well as the Ministry of Higher Education of Malaysia. This initiative has successfully developed and demonstrated zero waste processing technology for the palm oil industry as well as trained more than 50 postgraduate students and postdoc research fellows, published more 250 high impact journal articles and secured more than USD10 million funding. Prof. Sobri has also established a network of collaboration that bring together experts from various countries who share the same vision and interest in circular solution. Recently, Sime Darby Foundation has extended the funding for sustainable development initiatives for another 10 years (2021-2030) for research and developmental work on smart circular solution.

Prof. Sobri is a registered Professional Engineer with the Board of Engineers Malaysia, a registered Chartered Engineer (CEng) with the UK Engineering Council and a Fellow of The Institution of Chemical Engineers, UK. His research interest addresses many aspects of environmentally sustainable biochemical and chemical processes.

Abstract

Circular Solution for Palm Oil Mill Effluent

The palm oil industry is the key driver for rural development in Malaysia that provides employment to more than half a million Malaysian populations, however the industry is facing numerous environmental challenges due to the wastes that are generated during the production process. The key waste from palm oil processing is the effluent or commonly known as POME, where for every ton of fresh fruit bunch (FFB) processed, 0.6 – 0.7 tons of effluent (POME) is produced. In addition to the effluent, 0.37 tons of solid wastes that is made up of empty fruit bunch, 0.22 tons (EFB), shell, 0.6 tons and fibres, 0.9 tons are generated per ton of of FFB. The conventional treatment method for POME is by using open ponds where it is subjected to a series of biological treatments. However, this method suffers from emission of GHGs namely CH4 and CO2 due to the anaerobic and aerobic processes, respectively. An integrated or circular solution to POME can can be achieved by utilising POME and the other processing byproducts as resources to produce energy and water that is required in the processing stages. The POME and the fibres can be used to produce biohydrogen and biogas via anaerobic digestion. The partially treated effluent can be further treated to recover the water. In addition, the POME and the fibres can also be utilised to produce organic fertilisers.

Ir. Ts. Hj. Mohamed Haniffa Hj. Abdul Hamid

Fellow of Academy of Sciences (FASc)

Adjunct Professor
Department of Chemical and Environmental Engineering, UTM

Biodata

Ir. Ts. Hj. Mohamed Haniffa Hj. Abdul Hamid, FASc, is a Professional Engineer registered with the Board of Engineers Malaysia and his last position was the Chief Operating Officer (COO) of IWK until October 2020. His main areas of expertise are in infrastructure developments, water & wastewater management and river management. He was the first Malaysian selected by the British High Commissioner to undergo an intensive management program at the Templeton College (Oxford University's Business School) in 1997. Haniffa is a member of various Professional Institutions including the Chartered Institution of Water & Environmental Management (UK), the International Water Association (UK), and Vice President of the Malaysian Water Association. He was also appointed as one of the first Director of the Malaysian Water Academy, a body set up for Capacity Development for the Local Water Industry, an EIA Consultant registered with the Department of Environment Malaysia and a Professional Technologist registered under Malaysian Board of Technologists. Haniffa is also a Fellow of Institution of Engineers, Fellow of Academy of Sciences Malaysia, a Chartered Water and Environment Manager, UK and ASEAN Chartered Professional Engineer.

Over the years, Haniffa has directly and indirectly contributed to the development of sewerage industry in Malaysia particularly in the areas of governance, policy directions, institutional reforms, standards & guidelines development, designs, construction, operations & maintenance, research & development, quality control and environmental & safety management. Haniffa is currently an Adjunct Professor at UTM. Recently, he had been appointed as an Accreditation Board Member at Chartered Institution of Water and Environmental Management (CIWEM), London (UK).

Abstract

Opportunities and Prospects in the Domestic Wastewater Sector

Scientifically, there is no such thing called “Wastewater”. It is the wasteful way on how we perceive and use water that had led to this common universal term recognized by all as Wastewater. We need to look critically at water as a commodity and resource. Wastewater is actually used water that can be recovered and utilized. Water is perhaps the most valuable resource on planet earth and it is the key ingredient for any life forms. The total quantity of water that existed millions of years ago remain the same as what we have on planet earth today. It is the quality and location of these water that had varied due to mankind and climate interventions. Hence, the so called wastewater (or used water) needs critical insights and paradigm shifts for reuse and resource recovery for the benefit of all. From a Holistic viewpoint, there needs to be a shift from the traditional view of “wastewater as a problem and threat”, towards “wastewater as a new resource”. There is an urgent need to take a wider view of wastewater as a potential resource for which various types of technologies to achieve and realize this are now readily available in the market. In tandem, there is a need for shift in the mindset of key policy makers and stakeholders driving the Water Industry. To begin with, relevant policies to recognize these potentials need to be formulated and thereafter, strategic planning to facilitate the implementation of the policy should be instituted. Appropriate Strategies and Plans must be formulated to further drive the sewerage sector to attain the full potential of wastewater as a resource with creative financing options unleased for realization. This talk is intended to share and demonstrate the practical strategic approaches in harnessing circular economy potentials within the domestic wastewater sector and to unveil its various opportunities and prospects. The talk would provide a Birdseye perspective to various stakeholders including policymakers, businesses and researchers to explore and unleash new paradigms within this sector. The worldwide wastewater industry transformation to be more vibrant in unlocking the potentials by creating wider scope expansions and resource recovery moving into the future is also discussed.

Prof. Dr. Dragan Savić

Professor of Hydroinformatics
University of Exeter, United Kingdom

Chief Executive Officer - KWR Water Research Institute
WHO Collaborating Centre on Water Quality and Health

Distinguished Professor
Faculty of Engineering and Built Environment, UKM

Biodata

Professor Savić is Chief Executive Officer at KWR Water Research Institute based in the Netherlands and Professor of Hydroinformatics at the University of Exeter in the UK. He is an international expert in smart water systems with over 35 years of experience working in engineering, academia and research consultancy. His work has resulted in patentable innovation and spinout companies. In addition to innovation and leadership skills, he is known for believing in bridging science to practice in the wider water sector and utilities in general.

Prof. Savić's research interests cover the interdisciplinary field of Hydroinformatics, which transcends traditional boundaries of water/environmental sciences, informatics/computer science (including Artificial Intelligence, data mining and optimisation techniques) and environmental engineering. With over 22,000 citations to his name (source: Google Scholar) and h-index of 73, Prof. Savić is among the top 10 most cited scholars in the world in the areas of: 'hydroinformatics', 'water resources systems', 'water engineering' and 'floods': http://tinyurl.com/dragan-scholar. He is elected Fellow of the UK Royal Academy of Engineering (FREng) and a member of the European Academy of Sciences (EurASc).

Abstract

Digital Water Transition: Lessons Learned from Tesla and Boeing

Provision of water and sanitation services is one of the key challenges worldwide. The size, complexity and the critical nature water and wastewater infrastructure providing those services make planning and management of these systems extremely difficult. Following on from the digital revolution in many areas of our lives, the water sector has begun to benefit from digital transformation. Effective utilisation of remotely sensed weather and soil moisture data for more efficient irrigation (for food production), better detection of anomalies and faults in pipe networks using artificial intelligence, the use of nature-inspired optimisation to improve management and planning of systems, greater use of digital twins and robotics, all show a great potential to change and improve how complex water systems are managed. However, there are additional risks associated with those developments, including, but not limited to, cybersecurity, incorrect use and overconfidence in the capability and accuracy of digital solutions and automation. This talk will present key digital technology advances, which have found application in the water sector, and the key results of applying forensic engineering principles to failures experienced in industries that are further ahead with automation and digital transformation. By identifying what went wrong with the new digital technology that might have contributed to some high-profile accidents in the car and aircraft industries (e.g., Tesla self-driving cars and Boeing 737 Max), it is possible to identify similar risks in the water sector, learn from them and prevent future failures. These findings point to major future research areas related to the digital transformation in the water sector.

Prof. Dr. Faisal Khan (P.Eng)

Professor
Faculty of Engineering & Applied Science
Memorial University of Newfoundland, Canada

Associate Dean (Graduate Studies)
Director, Centre for Risk Integrity and Safety Engineering (C-RISE)

Canada Research Chair (Tier I) in Offshore Safety & Risk Engineering

Biodata

Dr. Faisal Khan is a Professor and the Canada Research Chair (Tier I) of Offshore Safety and Risk Engineering. He is the founder of the Centre for Risk Integrity and Safety and Engineering (C-RISE), which have over research 90 research members. His areas of research interest include offshore safety and risk engineering, inherent safety, risk management, and risk-based integrity assessment and management. He is actively involved with multinational oil and gas industries on the issue of safety and asset integrity. In 2006, he spent eight months as a risk and integrity expert with Lloyd's Register, a risk management organization in UK. He also served as the Safety and Risk Advisor to Government of Newfoundland, Canada. He continues to serve as a subject matter expert to many organizations that include Llyod's Register EMEA, SBM Modco, Intecsea, Technip, and Qatargas. In 2008-10, he visited Qatar University and Qatargas LNG Company as the Process Safety and Risk Management Research Chair. In 2012-14 he served as a Visiting Professor of Offshore and Marine Engineering at Australian Maritime College (AMC), University of Tasmania, Australia where he led the development of offshore safety and risk engineering group and the initiative of global engagements with many international institutions. He is the recipient of President Outstanding Research Award of 2012-13 at Memorial University, CSChE National Award on Process Safety Management of 2014, President Outstanding Research Supervision Award of 2013-14 at Memorial University, and recently Society of Petroleum Engineer award for his contribution in Health, Safety and Risk Engineering. He has authored over 500 research articles in peer-reviewed journals and conferences on safety, risk and reliability engineering. He has authored five books on the subject area. He is the Editor for the Journal of Process Safety and Environmental Protection, Process Safety Progress, and ASME Part A (Risk and Uncertainty Analysis). He regularly offers training program/workshop on safety and risk engineering in different places including St John's, Chennai, Dubai, Beijing, Aberdeen, Cape Town, Doha and Kuala Lumpur.

Abstract

Application of Electrochemical Process to Enhance Treatment Efficiencies

In recent years there have been significant advancement in the wastewater treatment. Among these methods electrochemical process such as Microbial Fuel Cells (MFCs) has emerged as a most effective technology. MFCs focussed on the interaction between microbes and the conductive materials/electrodes, which leads to the high catalytic rate at the microbe-electrode interface. The initial benefit of the amicable interaction between microbes and the conductive materials is that it can boost microbial metabolism in an electron acceptor deficit anaerobic environment. Constructed wetlands (CWs) are recognised as resilient, economical, and decentralised eco-friendly option for meeting water treatment challenges. CWs systems use plants and naturally occurring microorganisms to remove pathogens, nutrients, and sediments present in water. Integrating of MFCs into constructed wetlands helps to enhance the wastewater treatment efficiency, it also assists in generating electricity that can be used for various applications in wastewater treatment facilities. This pioneering technology has demonstrated great potential for wastewater treatment with simultaneous electricity generation. This presentation aims to provide an understanding of anaerobic microbe-electrode interaction in CW-MFC to remove various pollutants such as carbon, nitrogen, sulphate, toxic heavy metal, dye from wastewater. The presentation also focussed on investigating a way of harvesting energy, its storage and practical application of bioenergy generated from CW-MFC.

Prof. Ir. Dr. Fatihah Suja'

Professor
Department of Civil Engineering
Faculty of Engineering and Built Environment, UKM

Faculty Head of Quality Assurance, UKM

Biodata

Ir. Dr. Fatihah is a Professor in the Department of Civil Engineering, Faculty of Engineering and Built Environment. She received her PhD in Civil Engineering from the University of Newcastle Upon Tyne, Newcastle United Kingdom on 2004 and MSc in Chemical Engineering from Universiti Kebangsaan Malaysia on 1997. She has authored more than 130 research articles in peer-reviewed journals with citations exceeding 1500 and h-index of 21.

She is currently serving as the Faculty Head of Quality Assurance. She is a registered Professional Engineer with the Board of Engineers Malaysia (BEM) and a member of The Institution of Engineers, Malaysia (IEM), EIA Assistant Consultant and International Water Association (IWA). Her research interest addresses many aspects of green technology which include aerobic process, anaerobic process, bioremediation, bioleaching, solar.

Abstract

Waste Water Treatment Plant Design and Optimization

Choosing the best wastewater treatment system is a very complex process and requires substantial understanding of treatment fundamentals and experience in managing treatment operation. Regardless of how advanced the wastewater treatment technology is today, wastewater treatment plants should be developed and designed after the higher tiers of Waste Management Hierarchy are adopted. Design phase and control strategies require complete information on the physical, chemical and biological characteristics of the wastewater and the quality that must be maintained in the environment to which the wastewater is to be discharged or for the reuse. In addition, the environmental standards or discharge requirements must be met applicable. Green engineering design should be the guiding principles. Green wastewater treatment systems a) minimize emissions with respect to organics, nutrients and odour b) promote multiple resources of clean water, energy or sludge recovery c) save energy consumption on aeration and pumping facilities d) improve system loading capacity through process intensification and e) control optimal operating condition. A successful design and optimization will ultimately lead to alternative fuel development, new means of generating energy and creation of energy-efficient and cost-saving wastewater treatment plant operation.