the international water association

Leading-Edge
Technology

PROGRAMME BOOK

10th IWA Leading Edge Conference on Water and Wastewater Technologies

Organised by:

the international water association

suez environnement

Sponsors:

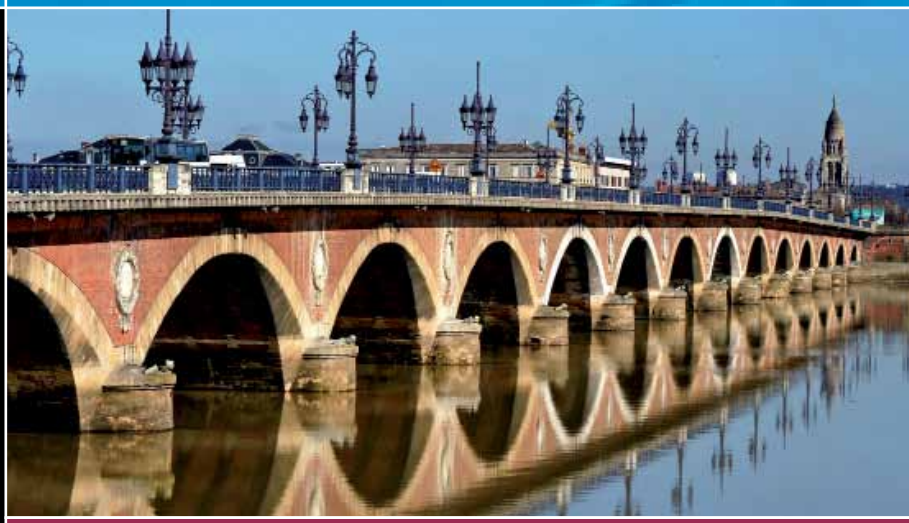
suez environnement Lyonnaise des Eaux

TECHNOLOGIES

Supporting publication:

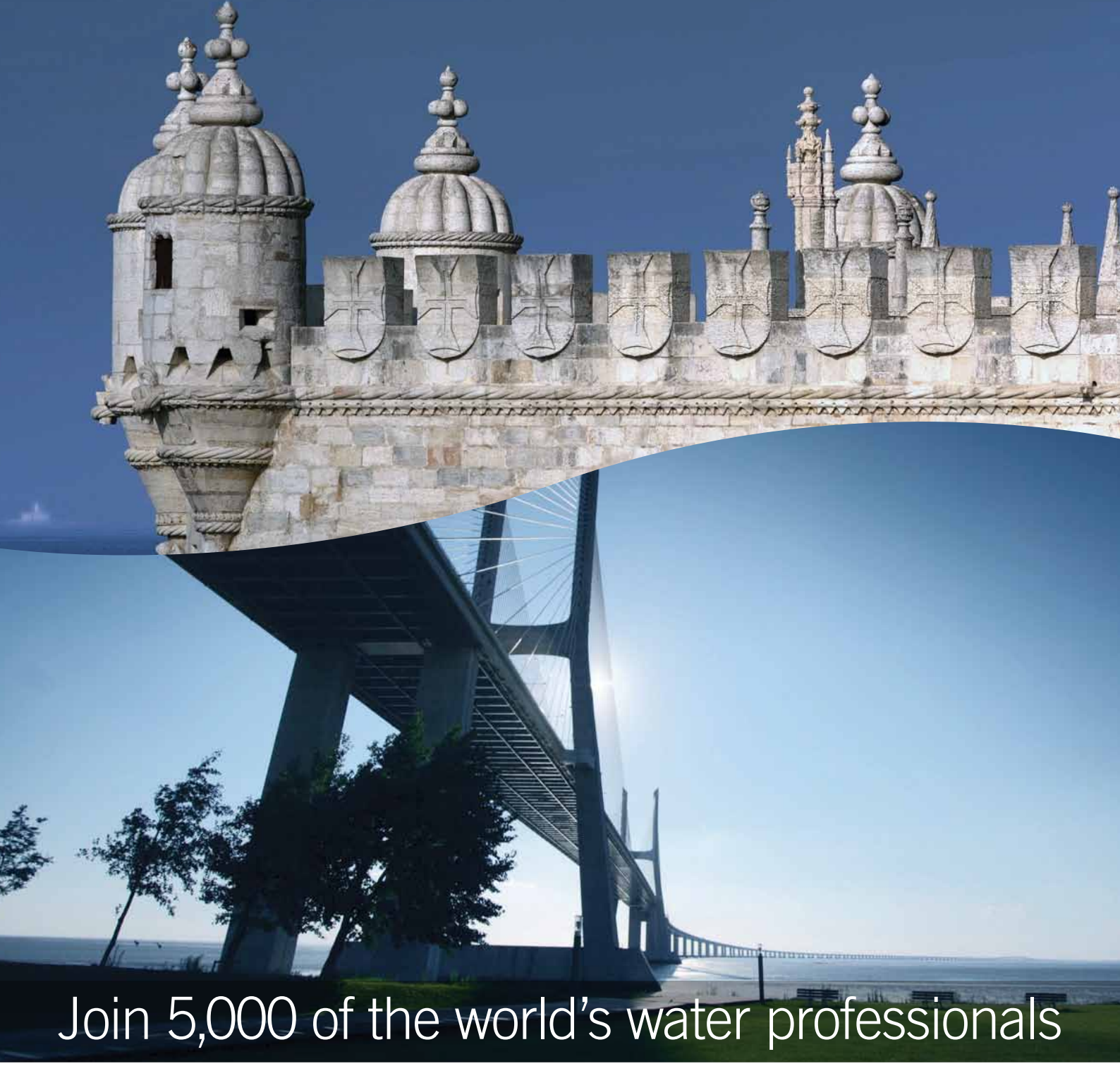
water21 magazine of the International Water Association

LEADING-EDGE



2 - 6 June 2013
Centre de Congrès Cité Mondiale
Bordeaux, France

www.let2013.org



Join 5,000 of the world's water professionals

Every two years the world's leading water professionals gather at the IWA World Water Congress & Exhibition to discuss the world's leading water issues. There is no better or easier opportunity to meet with key contacts in the international water community. Over the six days of the congress, you can meet current colleagues, make new contacts, expand your client base, meet new research partners, exchange knowledge and experiences, and create new solutions to the world's water questions.

IWA the international water association

World Water Congress & Exhibition

21–26 September 2014
Lisbon Portugal

Find out more at
www.iwa2014lisbon.org

Organisers

IWA the international water association

CNaia Comissão Nacional da Associação Internacional da Água

EPAL Grupo Águas de Portugal

CONTENTS

Welcome from the IWA President

The 2013 edition of the flagship IWA LET conference returns to Europe and to a new venue, Bordeaux, France. While the venue is new, the forward-looking nature and excellence of the event remain. As the leading edge technology conference, this series looks over the horizon to those technologies which will shape the practice of water and wastewater treatment in the years to come.

The content is provided by the "best of the best", and the attendees list includes those who can help advance your ideas. Thus, it is a must event for those working on these next generations of technology. The program includes both invited papers, but especially those from the innovators who are inventing the future of water and wastewater treatment, like yourself.

So, share your ideas and advances with those who need to know and who can also help you further refine and advance them. Bordeaux is also a lovely location which will further the intellectually stimulating but collegial atmosphere that IWA LET conferences are noted for.

I look forward to engaging with each and everyone of you over the next three days at the conference.

Glen Daigger
President
International Water Association (IWA)

Welcome from the Chairman of the Organising Committee

On behalf of the Organising Committee, I welcome you to the 10th IWA's Leading Edge Technology Conference. The conference is being held at the Cité Mondiale in the city of Bordeaux, the economic hub in southwestern France constitutes the sixth-largest urban area in France. Bordeaux as a port city on the Garonne River has a strong link with water and environment.

At this event, we have high quality program comprising of leading water researchers and technology practitioners from all over the world. Parallel tracks offering a wide range of multidisciplinary presentations will provide ample opportunities to learn and network with professionals in your fields of interest. Technical tours are also being planned to demonstrate local applications of advanced water, wastewater and stormwater technologies and management.

In addition the city of Bordeaux and its surrounding area offer great opportunities for recreation. The historic part of the city of Bordeaux is on the UNESCO World Heritage List as "an outstanding urban and architectural ensemble" of the 18th century. Bordeaux has more than 350 classified buildings and buildings listed as Historic Monuments, including 3 religious World Heritage buildings since 1998 as part of the Routes of Santiago de Compostela in France. Bordeaux is also well known as a world's wine capital.

I look forward to meeting you in Bordeaux. Together we will make this conference a success.

Philippe Gislette
Chairman
Organising Committee

About IWA

The International Water Association (IWA) is a global network of water professionals, spanning the continuum between research and practice and covering all facets of the water cycle. Through IWA members collaborate to promote the development and implementation of innovative and effective approaches to water management. The strength of IWA lies in the professional and geographic diversity of its membership – a global mosaic of member communities, including academic researchers and research centres, utilities, consultants, regulators, industrial water users and water equipment manufacturers. IWA members from each of thee communities represent the leading edge in their fields of expertise; together they are building new frontiers in the research and implementation of water and wastewater treatment technologies, with the framework of the total water cycle.

About SUEZ ENVIRONNEMENT

Natural resources are not infinite. Each day, SUEZ ENVIRONNEMENT and its subsidiaries deal with the challenge of protecting resources by providing innovative solutions to industry and to millions of people. SUEZ ENVIRONNEMENT supplies drinking water to 91 million people, provides wastewater treatment services for 63 million people and collects the waste produced by 57 million people. SUEZ ENVIRONNEMENT has 79,550 employees and, with its presence on five continents, is a world leader exclusively dedicated to water and waste management services. In 2012, SUEZ ENVIRONNEMENT, a subsidiary in which GDF SUEZ has a 35.7% interest, generated revenues of EUR 15.1 billion.

About Lyonnaise des Eaux

Lyonnaise des Eaux is the subsidiary of SUEZ ENVIRONMENT in France, which is in charge of water and wastewater systems management, operation and maintenance. With more than 3,000 contracts with municipalities, Lyonnaise des Eaux is one of the leading water operators in France, and the historical operator of Bordeaux urban community water and waste water systems.

About PWN Technologies

PWN Technologies—innovative designs for sustainable, advanced water treatment. PWN Technologies, a subsidiary of water supply company PWN, was established to make the utility's innovations in water treatment available to water companies worldwide. The revenues of PWN Technologies are invested in research and development to strengthen PWN's position as an innovative water supply company. PWN Technologies has developed advanced and sustainable solutions in water treatment, based on suspended ion exchange, ceramic membrane applications and advanced oxidation. PWN Technologies also delivers innovative solutions for drinking-water production in emerging countries. PWN Technologies is located in Velserbroek (HQ Netherlands), Andijk (Netherlands) and Singapore.

Advisory Committee and Core Group

- Pedro Alvarez, Rice University, USA
- Jonathan Clement, PWN technologies, The Netherlands
- Jurg Keller, The University of Queensland, Australia
- Mark van Loosdrecht, Delft University of Technology, The Netherlands
- Bruce Rittmann, Arizona State University, USA

Organising Commitee

- Philippe Gislette, SUEZ ENVIRONNEMENT, France
- Anne Couderc, SUEZ ENVIRONNEMENT, France
- Christophe Anselme, SUEZ ENVIRONNEMENT, France
- Xavier Litrico, SUEZ ENVIRONNEMENT, France
- Ryan Yuen, International Water Association, Singapore
- Hong Li, International Water Association, The Netherlands
- Gladys Ng, International Water Association, Singapore
- Orsolya Bagdi, International Water Association, The Netherlands

Programme Commitee

- Jurg Keller (Chair), The University of Queensland, Australia
- Peter Aerts, DOW Water & Process Solutions R&D, The Netherlands
- Pedro Alvarez, Rice University, USA
- Jean-Luc Bertrand-Krajewski, The INSA LGCIE, France
- Gilbert Galjaard, PWN Technologies, The Netherlands
- Urs von Gunten, Eawag, Switzerland
- Chung-Hak Lee, Seoul National University, Korea
- Juan Lema, Universidade de Santiago de Compostela, Spain
- Karl Linden, University of Colorado at Boulder, USA
- Wen-Tso Liu, University of Illinois at Urbana-Champaign, USA
- Mark van Loosdrecht, Delft University of Technology, The Netherlands
- Maite Pijuan, Catalan Institue for Water Research, Spain
- Lutgarde Raskin, University of Michigan, USA
- Wolfgang Rauch, University Innsbruck, Austria
- Bruce Rittmann, Arizona State University, USA
- Rene Rozendal, Paques bv, The Netherlands
- Kim Helleshøj Sørensen, WABAG Water Technology Ltd, Switzerland
- Willy Verstraete, Ghent University, Belgium
- Zhiguo Yuan, The University of Queensland, Australia

Conference Program

Sunday, 2 June 2013

12:00	Registration Opens		
14:00 - 17:30	**Workshop 1** **Smart Systems - Monitoring and Control in the Water Cycle** *Venue: Salle Brasilia 1 & 2*	**Workshop 2** **Bringing Leading Edge Technology to the Market - A path of Innovation** *Venue: Salle Brasilia 3*	**Workshop 3** **Emerging Challenges for a Sustainable and Integrated Urban Water System Management** *Venue: Salle Beijing*
18:00	**Welcome Reception at Jefferson Panoramic Room (Sponsored by PWN Technologies)**		

Workshop Sessions

Workshop 1 **Smart Systems - Monitoring and Control in the Water Cycle**
Moderator: Philippe Gislette

The aim of the workshop is to present the latest developments in the field of Monitoring and Control in the whole water cycle and exchange successful experiences worldwide. Topics to be developed will include drinking water treatment and distribution system management, wastewater treatment including wastewater collection, water reuse, and stormwater real time management. Examples of real-world implementations will be presented in order to allow discussions among attendees to the workshop and create collaborations between entities in the future.

Workshop 2 **Bringing Leading Edge Technology to the Market - A path of Innovation**
Moderators: Jonathan Clement and Paul O'Callaghan

One of the biggest challenges facing the water industry is to bring new technologies fully into the market place where they can be applied full-scale. Many effective appearing ideas spring out of bench scale research, but often never make it to market because the innovation process lacks many of the full-scale engineering and operational aspects. The process involves integrating many diverse resources and disciplines. This workshop will bring together successful innovators and technology companies for an exciting and insightful discussion on challenges and ways to improve bringing new technology in the market place.

Workshop 3 **Emerging Challenges for a Sustainable and Integrated Urban Water System Management**
Moderator: Joaquim Comas

The workshop is organized in the framework of the Europen project SANITAS "Sustainable and Integrated Urban Water System Management" - funded by the EU under the People programme - Marie Curie Initial Training Network. The aim of the workshop is to comprehensively address the possibilities of rethinking the management of the Urban Water System (UWS) in the context of emerging challenges (i.e. GHG, micropollutants, nutrient recovery, energy optimization/recovery, water reuse, etc.). The workshop will encourage the debate around the potential contribution of SANITAS research to a more sustainable UWS management from three broad perspectives: (1) modelling, (2) control and (3) decision support systems and multicriteria analysis.

Monday, 3 June 2013

Venue: Amphitheatre Brisbane

08:00	Registration Opens
09:00	**Opening Address** Philippe Gislette, Jurg Keller, Glen Daigger
09:30	**Wastewater as a Resource** Herve Buisson, Veolia Water Solutions & Technologies, USA
10:15 - 10:45	**Morning Tea/ Coffee**
10:45	**What can we expect from Chemistry in Water Industry?** Yannick Fovet, BASF SE, Germany
11:30	**(Microbial) Electrocatalysis – Electrochemistry for Environmental Processes** Korneel Rabaey, Ghent University, Belgium
12:15	**Algae Alchemy: Wastewater as Biofuel** Frank Rogalla, Aqualia, Spain
13:00 - 14:00	**Lunch**
14:00	**Biologically Stable Water: From Concepts to Practice** Frederik Hammes, EAWAG, Switzerland
14:45	**What Wastewater? A Solid Solution to Scaling** Geert-Jan Witkamp, Delft University of Technology, The Netherlands
15:30	**Scale-Up of the Aerobic Granular Sludge Technology** Bart de Bruin, Royal HaskoningDHV, The Netherlands
16:15 - 18:00	**Poster Session**

Plenary Speakers

Wastewater as a Resource
Herve Buisson, Veolia Water Solutions & Technologies, USA

While the recovery of water, energy, chemicals from wastewaters is not new, there is today a stronger market focus on products and resources recovery from municipal and industrial wastewaters. Market conditions and demands are evolving, while at the same time fast progresses in material sciences, biotechnology, digital sciences are leading to more efficient and cost effective recovery processes and operations: will that be enough for a global paradigm shift from environmental compliance to value creation? The presentation will use recent project examples to illustrate some of the challenges and great opportunities facing our water industry and community on our path to extract more value wastewaters.

What can we expect from Chemistry in Water Industry?
Yannick Fovet, BASF SE, Germany

Although water treatment has been mainly driven by innovative mechanical technologies for the last decades, chemistry became a strong enabler in early 20th century. This is what BASF - the chemical company wants to share, illustrating and documenting how chemistry did change the industrial world but also the domestic use. But what about tomorrow? How can chemistry fit with sustainability in our society? We will exchange on how chemistry can strongly contribute to overcome water stressed and scarcity, allowing population wherever they are to have access to clean water by using the chemistry-driven solutions for water market.

(Microbial) Electrocatalysis - Electrochemistry for Environmental Processes
Korneel Rabaey, Ghent University, Belgium

Electricity can be produced (almost) everywhere and increasingly in a sustainable manner. As an energy source, it can be used to drive electrochemical and bioelectrochemical processes in the context of green chemistry and environmental applications. The past few years we have seen a tremendous leap forward in the development of this technology. Examples of this are electrochemical removal of recalcitrant compounds, sulfide and nitrogen recovery, production of valuable organic and inorganic chemicals from waste liquids and gases. In all cases, using electricity avoids the use of chemicals to obtain the process, which in turn avoids adding salts to the liquid stream. In many cases, electrochemical and bioelectrochemical approaches are becoming economically competitive with existing approaches, which explains the increased focus on them. In this presentation, Korneel will provide an overview of the key applications emerging today, including the economic and technical status.

Plenary Speakers

Algae Alchemy: Wastewater as Biofuel
Frank Rogalla, Aqualia, Spain

Frank Rogalla's specialty is advanced treatment technology, where he holds a handful of patents and was instrumental in bringing high rate treatment systems to full scale for the first time. The consortium he compiled and is leading, All-Gas, is implementing one of the large EU projects to demonstrate ´Algae to Biofuel´ on a 10 ha scale. His talk will present details of this and related similar projects.

Biologically Stable Water: from Concepts to Practice
Frederik Hammes, EAWAG, Switzerland

Frederik Hammes' LET talk will deal with the topic of biological stability of water - a term loosely used to describe the absence of bacterial growth potential in engineered aquatic systems due to nutrient limitation or inhibition from to disinfectants. The presentation will explore the underlying principles governing biological stability, and specifically how a broad and inclusive conceptual and methodological approach allows for a better understanding, improved monitoring and possible control thereof.

What Wastewater? A Solid Solution to Scaling
Geert-Jan Witkamp, TU Delft, The Netherlands

For true Zero Liquid Discharge operation, a final step involving crystallisation of salts is required. As a cheaper alternative to evaporative crystallisation, eutectic freeze crystallisation (EFC) allows crystallisation of salts from concentrates with much less corrosion issues and with a better up-scaling potential, yielding highly pure water as ice. Industrial demonstrations at full continuous 200 L scale, experimental and design work as well as cost calculations have been performed for a variety of salt containing aqueous streams, including reverse osmosis retentates ex horticultural water treatment. The presentation will concretely address various aspects from technology to business".

Scale-up of the Aerobic Granular Sludge Technology
Bart de Bruin, Royal HaskoningDHV, The Netherlands

Aerobic granulation is considered as the possible future standard for industrial and municipal wastewater treatment and subsequently research efforts are quickly developing in this field. Recently, as an outcome of a concerted Dutch research and development program, an aerobic granular sludge technology has been scaled-up and implemented for the treatment of municipal and industrial wastewater. This Nereda® technology is considered being the first aerobic granular sludge technology applied at full scale. During the presentation the various scale-up aspects as well as the performance of various full-scale plants up to capacities of 140,000 person equivalents will be presented.

Tuesday, 4 June 2013

	Venue: Salle Brasillia 1, 2 & 3	*Venue: Amphitheatre Brisbane*
	SESSION 1: INNOVATIVE DESIGN, OPERATION, AND ROBUSTNESS OF MEMBRANE SYSTEMS FOR WATER AND WASTEWATER PROCESSES Chairs: Gilbert Galjaard and Chung-Hak Lee	**SESSION 2: GREENHOUSE GAS EMISSIONS FROM WATER AND WASTEWATER** Chairs: Maite Pijuan and Zhiguo Yuan
08:30	**Keynote (1): The pursuit of ultimate membrane technology and the progress of future essential membrane technolgy** Masaru Kurihara, Toray Industries Inc. (Japan)	**Keynote (1): Perspectives on greenhouse gas emission estimates based on Australian wastewater treatment plant operating data** David de Haas, GHD (Australia)
09:00	**Biofouling and its control: insights from nanotechnology** P. Alvarez (USA)	**Nitrous oxide emissions from wastewater: challenging assumptions** T. Stephenson, A. Aboobakar, G. Black, P. Vale, N. Johnson, R. Harnett, Y. Wang, E. Cartmell and G. Dotro (UK)
09:15	**Carbon nanotube blended thin-film composite membrane for water treatment** M. Son, H. Park, H. Choi, L. Liu and H. Choi (Korea)	**A novel methodology to quantify nitrous oxide emission from wastewater treatment systems with surface aerators** L. Ye, B. J. Ni; Y. Law, C. Byers and Z. Yuan (Australia)
09:30	Discussions	Discussions
10:00 - 10:30	**Morning Tea/ Coffee**	
10:30	**Keynote (2): Paradigm shift in biofouling control in MBR: bacterial quorum quenching** Chung-Hak Lee, School of Chemical and Biological Engineering, Seoul National University (Korea)	**Keynote (2): Key factors determining N_2O production by ammonia oxidising bacteria - the known and unkown** Maite Pijuan, Kartik Chandran, Mark van Loosdrecht and Zhiguo Yuan
11:00	**Conductive UF membrane as biocathode in air-cathode MFCs** L. Malaeb, K. Katuri; M. Husnul, S. Nunes, B. Logan and P. Saikaly (Saudi Arabia)	**Identification of N_2O production pathways in biological wastewater treatment based on stable nitrogen isotopes** P. Wunderlin, J. Mohn, M. Kipf, A. M. Lotito, A. Joss, L. Emmenegger and H. Siegrist (Switzerland)
11:15	**Sludge rheology and flow behavior - enhancing the cross flow in MBR with mechanical cleaning** W. Horn, S. Rosenberger, F. P. Helmus, A. Bareth and U. Meyer-Blumenroth (Germany)	**Confounding effect of nitrite on aerobic N2O production by an enriched ammoniaoxidising** Y. Y., Law (Singapore)
11:30	Discussions	Discussions
12:00 - 13:00	**Lunch**	
	SESSION 3: INDUSTRIAL WATER TREATMENT TECHNOLOGIES - CLOSING THE LOOP Chairs: Kim Helleshoj Sorensen and Peter Aerts	**SESSION 4: APPLICATIONS OF MOLECULAR MICROBIAL TECHNOLOGIES IN WATER SYSTEMS** Chairs: Wen-Tso Liu and Lutgarde Raskin
13:00	**Keynote (1): New challenges and sources for an existing industrial water loop** Jacobus Michiel Christian van Agtmaal, Jan Willem Mulde, Evides Industirewater BV. (The Netherlands)	**Keynote (1): Low-temperature anaerobic digestion for wastewater treatment** Vincent O'Flaherty, National University of Ireland, Galway (Ireland)
13:30	**Influence of the addition of nanofiltration concentrate on membrane bioreactor performance** C. Kappel, A. Zwijnenburg, H. Temmink, H. Rijnaarts, A. Kemperman and K. Nijmeijer (The Netherlands)	**Microbial characterization of primary colonizers on the membrane surfaces of full-scale MBR plants** G. Matar, S. Bagchi, K. Zhang, D. Oerther and P. Saikaly (Saudi Arabia)
13:45	**IFAS ANITA™Mox process - A new perspective for advanced N-removal** F. Veuillet, A. Bausseron, E. Gonidec, S. Lacroix, R. Lemaire, M. Christensson, P. Jouaffre and J. Ochoa (France)	**Major nitrification and denitrification bacterial communities in activated sludge revealed using combined metagenomic and metatranscriptomic approaches** K. Yu and T. Zhang (Hong Kong, China)
14:00	Discussions	Discussions
14:30 - 15:00	**Afternoon Tea/ Coffee**	

Tuesday, 4 June 2013 (continue)

	Venue: Salle Brasillia 1, 2 & 3	*Venue: Amphitheatre Brisbane*
15:00	**Keynote (2): Hospital wastewater treatment to the next level: removal of micropollutants by MBR, ozone, and GAC** Erwin Koetse, Pharmafilter (The Netherlands)	**Keynote (2): Studying biological drinking water treatment with molecular tools** Mary Jo Kirisits, University of Texas (USA)
15:30	**SIBSAC - An integrated system for sediments remediation and high salinity marine wastewaters treatment** G. Di Bella, G. Freni, M. G. Giustra, G. Mancini, V. Notaro, R. Pulvirenti, A. Ticali and G. Venusino (Italy)	**Tuning the performance of a natural treatment process using metagenomics for improved trace organic chemical attenuation** J. E. Drewes, D. Li, J. Regnery, M. Alidina, A. Wing and C. Hoppe-Jones (USA)
15:45	**Suitability of ozone pre-treatment for amoxicillin wastewater** O. Lefebvre, X. Shi, J. G. Tein and H. Y. Ng (Singapore)	**A new approach to assess the real effectiveness of disinfectants and the risk related to stressed bacteria** J. F. Loret, A. Dumont, M. Chabalier, M. Jousset and S. Dukan (France)
16:00	Discussions	Discussions
16:30	**End of Day**	

Wednesday, 5 June 2013

	Venue: Salle Brasillia 1, 2 & 3	*Venue: Amphitheatre Brisbane*
	SESSION 5: RESOURCE RECOVERY FROM WASTEWATER Chairs: Willy Verstraete and Rene Rozendal	**SESSION 6: STORMWATER COLLECTION, TREATMENT AND RECOVERY TECHNOLOGIES** Chairs: Jean-Luc Bertrand-Krajewski and Wolfgang Rauch
08:30	**Keynote (1): The carboxylate platform to convert organic materials from wastewater into valuable biochemical** Lars Angenent, Cornell University (USA)	**Keynote (1): Australian stormwater management: from research to implementation** David McCarthy, Monash University (Australia)
09:00	**A novel free nitrous acid (FNA)-based technology for enhancing methane production from waste activated sludge** Q. Wang, L. Ye, G. Jiang, P. Jensen, D. Batstone and Z. Yuan (Australia)	**Forward osmosis for the management of urban runoff in coastal regions** Z. Li, R. Valladares-Linares, M. Abu-Ghdaib and G. Amy (Saudi Arabia)
09:15	**Protein from WAS as a nutritional supplement in chicken feed** E. M. N. Chirwa and M. T. Lebitso (South Africa)	**Hydrogen sulphide odour control in box culverts/storm drains by iron-based granules** J. L. Sun, C. Shang and G. A. Kikkert (Hong Kong, China)
09:30	Discussions	Discussions
10:00 - 10:30	**Morning Tea/ Coffee**	
10:30	**Keynote (2): Microbial metal recovery: mechanisms and applied potential.** Geoffrey Michael Gadd, University of Dundee (UK)	**Keynote(2): Development and improvement of stormwater treatment technologies based on laboratory and numerical investigations with practical applications** Joerg Schaffner, Steinhardt Wassertechnik (Germany)
11:00	**Metal recovery from solutions with a biological sulphide generator** H. Dijkman and M. Olde Weghuis (The Netherlands)	**The survey of the simpified filtration for CSO control on the full scale plant** S. Ohchi, Y. Nakata, T. Chikusa, M. Takenaka and M. Ide (Japan)
11:15	**Capturing salinity gradient energy using thermolytic solutions in reverse electrodialysis stacks and catholyte solutions** B. Logan, R. D. Cusick, I. Ivanov, M. Hatzel and F. Zhang (USA)	**Optimization of urban stormwater depollution using the combination of real-time turbidity measurements and numerical simulations** P. Lalanne, M. Metadier, B. Barillon, T. Polard, G. Binet, C. Kabore and X. Litrico (France)
11:30	Discussions	Discussions
12:00 - 13:00	**Lunch**	

Wednesday, 5 June 2013 (continue)

	Venue: Salle Brasillia 1, 2 & 3	*Venue: Amphitheatre Brisbane*
	SESSION 7: NUTRIENT REMOVAL AND RECOVERY Chairs: Mark van Loosdrecht and Juan Lema	**SESSION 8: ADVANCED OXIDATION – NEW TECHNOLOGIES AND APPLICATIONS** Chairs: Karl Linden and Urs von Gunten
13:00	**Keynote (1): Main stream anammox: current projects and status** Sudir Murthy, Bernhard Wett and Mark van Loosdrecht	**Keynote (1): Micropollutant control by ozonation in urban wastewaters: AOP performances and key considerations** Sylvie Baig, Degremont (France) and Sophie Besnault, SUEZ ENVIRONNEMENT (France)
13:30	**Sulfide based denitrification in the SANI process** G.H. Chen, T. W. Hao, J. Qian, H. Lu, H. K. Chui and M. van Loosdrecht (Hong Kong, China)	**A novel advanced oxidation method for simultaneous disinfection and removal of organic micropollutants in wastewaters** T. Karpova, J. Ekman, E. Melin and A. Vuori (Finland)
13:45	**Comparison of environmental impacts of tertiary filtration technologies for advanced phosphorus removal via Life Cycle Assessment** C. Remy, U. Miehe and B. Lesjean (Germany)	**Enzymatic reactors as tertiary treatment for oxidation of Endocrine Disrupting Compounds (EDCs)** G. Eibes, L. Lloret, R. Taboada-Puig, A. Arca-Ramos, C. Martínez-Patiño, M.T. Moreira, G. Feijoo and J.M. Lema (Spain)
14:00	Discussions	Discussions
14:30 - 15:00	**Afternoon Tea/ Coffee**	
15:00	**Keynote (2): Assessing extractive nutrient recovery as a viable nutrient control alternative** Wendell Khunjar, Hazen and Sawyer P.C. (USA)	**Impact of ferrate treatment on natural organic matter** D. Reckhow, J. E. Tobiason, Y. Jiang and J. Goodwill (USA)
15:15		**Metal oxides enhanced bromate formation during chlorination of bromide-containing waters in distribution systems** C. Liu and J. P. Croue (Saudi Arabia)
15:30	**Microalgae-based treatment as an alternative for removing nitrogen and phosphorus from WWTP effluents** L. Lacoste, B. Barillon, L. Constans, A. Huyard, C. Peregrina and S. M. Ruel (France)	**Mitigation of I-DBPs and control of bromate formation during ozonation pre-treatment** S. Allard, C. Nottle, A. Chan, C. Joll, J. Charrois and U. von Gunten (Australia)
15:45	**Full scale recovery of nitrogen from ammonia rich sludge liquid and urine for the production of fertilizer by full scale air or membrane stripping** M. A. Boehler, M. Schachtler, J. Mohn, A. Heisele, W. Kunst, C. Liebi, S. Zulegg and H. Siegrist (Switzerland)	**Impact of chlorine on assimilable organic carbon in water treatment** M. J. Stefan and S. Sarathy (Canada)
16:00	Discussions	Discussions
16:30	**Closing Session**	
19:00 - 22:00	**Gala Dinner at Palais de la Bourse (Sponsored by Lyonnaise des Eaux)**	

Social Programmes

LET 2013 Welcome Reception (Sponsored by PWN Technologies)

Date: 2 June 2013, Sunday

Venue: Jefferson Panoramic Room
7th floor, Mercure Bordeaux Cité Mondiale Centre de Congrès (same building as the conference venue)

Time: 6pm to 8pm

The welcome reception offers you vast networking opportunities to meet other attendees and speakers. Start generating stimulating and insightful dialogues among the guests before the conference commences the next day.

Technical Visits

Date: 6 June 2013, Thursday

Time: Option 1: 8:30am to 12:30pm
Option 2: 1:30pm to 5:30pm

Delegates joining the technical visit on 6 June will get the opportunity to visit three venues: Ramsès: Wastewater and Storm Water SCADA (Supervisory Control And Data Acquisition) Centre, Grenouillère: storage and depollution rainwater tank and Clos de Hilde: Wastewater Treatment Plant.

Refer to page 10 for more information on technical visits.

LET2013 Gala Dinner (Sponsored by Lyonnaise des Eaux)

Date: 5 June 2013, Wednesday

Venue: Palais de la Bourse
17 Place de la Bourse, 33076 Bordeaux, France

Time: 7pm to 10pm

No trip to Bordeaux is complete without a visit to the Palais de la Bourse with its majestic royal square dedicated to the French ruler Louis XV and the spectacular view of the city. The architect of Place de la Bourse and the surrounding buildings was the famous French architect Ange-Jacques Gabriel, who also is responsible for several other major projects, such as Place de la Concorde in Paris and parts of the Château de Versailles.

Technical Visits

Delegates joining the technical visit on 6 June will get the opportunity to visit the following three venues.

Ramsès: Wastewater and Storm Water SCADA (Supervisory Control And Data Acquisition) Centre

Implemented in 1992 by the Bordeaux Metropolitan Area, Ramsès is the central supervisory control center initially dedicated to the control and management of flood risk. In addition, Ramsès has become a global tool for wastewater and stormwater monitoring since 2007. Ramsès performs real-time monitoring of a large number of data coming from sensors and actuators, including pumps, gates, water level sensors, etc.

* Photo credits: David and David

Since 2012, a real-time global optimal predictive control tool has been implemented to control and depollute the Louis Fargue catchment. This tool is now operational and is unique in Europe. It is able to reduce by 50% the volumes of combined sewer overflows.

In December 2012 an educational area was opened on the first floor of the control centre building. It presents the story of rainwater harvesting and the fight against flooding within the Bordeaux Metropolitan Area from the Second World War to today.

Grenouillère: storage and depollution rainwater tank

* Photo credits: David and David

The Grenouillère underground storage tank is one of the most important achievements of the flood prevention and rainwater harvesting plan. With a diameter of 60 m and a depth of 24 m, this amazing underground civil works can store up to 65,000 m^3 of rainwater.

Put into service in 2002 following huge construction works lasting more than two years, the tank remains unknown to the public despite its vast size.

During the visit, the participants will be able to access inside the tank itself (if conditions permit).

Clos de Hilde: Wastewater Treatment Plant

Clos de Hilde wastewater treatment plant was created to process wastewater, sludge from the clean-up process but also to get rid of sound and olfactory nuisances.

Clos de Hilde treatment plant located in Bègles is one of the main elements of Bordeaux urban conglomeration wastewater treatment system. It also is one of the most efficient wastewater treatment plants in Europe.

In 2011, 64,4 millions m3 of waste water were treated there before their release into the environment.

the international water association

Leading-Edge
Technology

10th IWA Leading Edge Conference on Water and Wastewater Technologies

Platform Presentations Index

Platform Presentations Index

Platform Presentations Index

the international water association | Leading-Edge Technology

10th IWA Leading Edge Conference on Water and Wastewater Technologies

Platform Presentations Abstracts

Platform Presentations Abstracts

SESSION 1: INNOVATIVE DESIGN, OPERATION, AND ROBUSTNESS OF MEMBRANE SYSTEMS FOR WATER AND WASTEWATER PROCESSES

Keynote (1): The pursuit of ultimate membrane technology and the progress of future essential membrane technology

M. Kurihara

Based on the 50 year's research history on RO and other membranes, recent trends and mission of research have been much changed from the seed-oriented research to the need-oriented research. The targets of recent research are very clear as shown in
1) Reduction of energy
2) Low environmental impact
3) Low water production cost.
Global research activities are largely divided into two groups.
1) Ultimate RO membranes, based on commercially available membrane.
2) Post RO Innovative membranes: future essential membrane technology.
Ultimate RO membrane technology was done by "Mega-ton Water System" project by Japanese government sponsored R&D, which has been much progressed now.
1) As ultimate RO membranes, the fine structural analysis of functional layer in RO membrane, especially precise estimation of "protuberance" structure is very important.
A. Pore size Analysis of "protuberance" was done by "Positronium Annihilations Life- times Spectroscopy. The pore radius is 0.27-0.35nm and good correlationship with boron removal rates.
B. Precise estimation of the "Protuberance" structure was done by Elemental mapping by STEM-EELS. The clear picture of "protuberance" was obtained.
By controlling the "protuberance" structure formation, high performance low pressure seawater RO membrane was produced, which makes it possible to operate below 5 Mpa to reduce 20-30% energy consumption.
2) On the other hand, as post RO innovative membrane technology, FO/PRO membranes are still cellulose acetate or polyamide by the interfacial polymerization as membrane materials.
Even the bio-mimetic membrane (Aquaporin) or carbon nano tube membranes is also the hybrid polyamide membrane, which means that the real work of Aquaporin or carbon nano tube is not clear yet.
3) As non chemical SWRO operation system, We found that chemical addition become the trigger of bio fouling by side-by-side evaluation of deep seawater and surface seawater with or without chemicals.
These results are also supported by the change of the microbial community structure distinctly.

Masaru Kurihara, Toray Industries Inc., JAPAN (masaru_kurihara@nts.toray.co.jp)

Biofouling and its control: insights from nanotechnology

P. Alvarez

The extraordinary properties of some nanomaterials offer leapfrogging opportunities to develop next-generation applications for drinking water disinfection and safer wastewater reuse (e.g., photocatalytically-enhanced disinfection, biofouling-resistant membranes, and biofilm- and corrosion-resistant surfaces). This presentation will focus on two anti-biofouling examples: (1) interruption of bacterial quorum sensing to deter microbial attachment to surfaces, and (2) the application and novel mechanistic insight on silver nanoparticles (AgNPs).

Pedro Alvarez, Civil and Environmental Engineering, Rice University, USA (alvarez@rice.edu)

Carbon nanotube blended thin-film composite membrane for water treatment

M. Son, H. Park, H. Choi, L. Liu and H. Choi

Nano materials are getting attention as alternative materials for increasing membrane performances without a decrease in selectivity for water treatment. Above all, carbon nanotube is one of the most impressive materials to increase membrane permeability after functionalization due to the hydrophilic functional group and inner holes, which are act as selective nano-pores. Therefore, carbon nanotube blended thin-film composite membrane is used for water treatment to verify changing of membrane performances in this study.

Heechul Choi, School of Environmental Science and Engineering, Gwangju Institute of Science and Technology, KOREA (hcchoi@gist.ac.kr)

Platform Presentations Abstracts

SESSION 1: INNOVATIVE DESIGN, OPERATION, AND ROBUSTNESS OF MEMBRANE SYSTEMS FOR WATER AND WASTE-WATER PROCESSES

Keynote (2): Paradigm shift in biofouling control in MBR: bacterial quorum quenching

C. H. Lee, H. S. Oh and S. R. Kim

In this work, indigenous QQ bacteria producing AHL-lactonase were isolated from a real membrane bioreactor (MBR) plant and then immobilized into a microbial vessel (MV) or cell entrapped beads (CEB). The efficiencies of MV and CEB were examined and found to be remarkable in a continuous submerged MBR. The successful control of biofouling in a laboratory scale MBR suggests that biofouling control through the interspecies quorum quenching could be expanded to the plant scale of MBR with economic feasibility.

Chung-Hak Lee, School of Chemical and Biological Engineering, Seoul National University, KOREA (leech@snu.ac.kr)

Conductive UF membrane as biocathode in aircathode MFCs

L. Malaeb, K. Katuri, M. Husnul, S. Nunes, B. Logan and P. Saikaly

A new hybrid system combining the advantages of microbial fuel cells (MFC) and membrane bioreactors (MBR) was constructed using a conductive ultrafiltration membrane, employed as a biocathode in a MFC. The biocathodic MFC/MBR (BC) was compared against a similar system with a platinum-based cathode (PtC). With real wastewater as feed, the maximum power densities were 0.38 W m–2 (BC) and 0.82 W m–2 (PtC). Removal rates for COD, nitrate and phosphate were comparable to those of MBRs and reached respectively 97.5 ± 0.7%, 99.2 ± 0.1% and 89.6 ± 1.8% (BC) and 96.9 ± 0.14%, 98.6 ± 0.2% and 77.4 ± 9.4% (PtC). Flow cytometry showed a significant removal of bacterial cells in the permeate of the BC (76-92%).

Lilian Malaeb, Water Desalination and Reuse Research Center, King Abdullah University of Science and Technology, SAUDI ARABIA (Lilian.Malaeb@kaust.edu.sa)

Sludge rheology and flow behavior - enhancing the cross flow in MBR with mechanical cleaning

W. Horn, S. Rosenberger, F. P. Helmus, A. Bareth and U. Meyer-Blumenroth

The aim of this work is to improve the membrane cleaning performance in membrane bioreactors (MBR) by studying the impact of activated sludge (AS) rheology on the cross flow induced by membrane aeration. A uniform distribution of air bubbles is a key goal for an efficient fouling control. This effect is even more important in combination with mechanical membrane cleaning by introduction of plastic particles to the cross flow. Due to higher total solid concentration compared to conventional wastewater treatment plants the AS in MBR reveals higher sludge viscosity. Therefore, flow behavior is influenced in a way that e.g. the air bubble plume diameter decreases significantly. Strategies and constructions to ensure efficient cleaning were investigated and linked to the rheological properties of AS.

Willi Horn, Osnabrück University of Applied Sciences, GERMANY (w.horn@hs-osnabrueck.de)

Platform Presentations Abstracts

SESSION 2: GREENHOUSE GAS EMISSIONS FROM WATER AND WASTEWATER

Keynote (1): Perspectives on greenhouse gas emission estimates based on Australian wastewater treatment plant operating data

D. de Haas, C. Pepperell and J. Foley

Primary operating data were collected from up to forty wastewater treatment plants located across Australia. The size range of plants was indicatively from 850 to 650,000 person equivalents. Direct and indirect greenhouse gas emissions were calculated using a mass balance approach and default emission factors, similar to those used in Australia's National Greenhouse Energy Reporting System (NGERS) and IPCC guidelines. A Monte Carlo-type combined uncertainty analysis was applied to the primary inventory data as well as some of the key emission factors. The results suggest that Scope 2 (indirect emissions due to electrical power purchased from the grid) dominate the emissions profile for most of the plants (indicatively half to three quarters of the average estimated total emissions). This is only offset for the relatively small number of plants (in this study) that have significant on-site power generation from biogas. For plants with anaerobic digestion, inventory data issues around theoretical biogas generation, capture and measurement were sometimes encountered that can skew reportable emissions. Typically, nitrous oxide (N_2O) emissions dominated the Scope 1 (direct) emissions. However, N_2O still only accounted for approximately 10% to 20% of total emissions. This conservative estimate is based on the 'default' NGERS steady-state emission factor, which amounts to 1% of nitrogen removed through biological nitrification-denitrification process in the plant (or indicatively 0.7% to 0.8% of plant influent total nitrogen). Current research suggests that true N_2O emissions may be much lower and certainly not steady-state. Scope 3 (other indirect) emissions (e.g. due to electrical power transmission; chemicals; biosolids transport and disposal etc.) typically accounted for around 10% or less of the estimated total emissions. The results of this study help to place in context research work that is focused on direct emissions (including N_2O) from WWTPs. It appears that opportunities to reduce indirect emissions as a result of modest savings in power consumption are at least in the same order as those from reducing N_2O emissions.

David de Haas, GHD, AUSTRALIA (David.deHaas@ghd.com.au)

Nitrous oxide emissions from wastewater: challenging assumptions

T. Stephenson, A. Aboobakar, G. Black, P. Vale, N. Johnson, R. Harnett, Y. Wang, E. Cartmell and G. Dotro

The commonly accepted assumptions relating to the emissions of greenhouse gas (GHG) emissions, in particular nitrous oxide (N_2O), in aerobic wastewater treatment processes and sewers may be erroneous and result in under-accounting of the water industry's carbon footprint. A nitrifying activated sludge plant was shown to emit methane generated in-lane; nitrous oxide emissions from a trickling filter works had an emission factor two-fold greater than a conventional activated sludge plant; and nitrous oxide emissions were found to be above the atmospheric concentrations in a sewer pumping station. Future efforts should be focused on detailed profiles of emissions to enable more accurate carbon accounting of the overall wastewater process.

Tom Stephenson, Cranfield University, UK (t.stephenson@cranfield.ac.uk)

A novel methodology to quantify nitrous oxide emission from wastewater treatment systems with surface aerators

L. Ye, B. J. Ni, Y. Law, C. Byers and Z. Yuan

A novel methodology integrating on-line monitoring, off-line sampling, mathematical modelling and mass balance was developed to quantify nitrous oxide (N_2O) emission from wastewater treatment systems with surface aerators. The methodology was applied to quantify the N_2O emission from the Kwinana wastewater treatment plant (WWTP) in Australia, an open oxidation ditch (OD) system with surface aerators. A mathematical model based on currently known metabolic pathways for N_2O productions by both ammonia-oxidising bacteria (AOB) and heterotrophic denitrifier was established and calibrated to facilitate the calculation of the N_2O emission from the surface aerator zone. The model described well the dynamic ammonium, nitrite, nitrate, dissolved oxygen (DO) and liquid phase N_2O data collected from Kwinana WWTP. It is the first time that mathematical modelling of N_2O emissions is conducted successfully for a full scale WWTP. The determined N_2O emission factor over a full month was 0.52 ± 0.16% of the nitrogen load to the treatment plant, with over 90% of the emission from the surface aerator zone. The modelling results indicated that the NH_2OH related pathways might be the dominant N_2O contributors under fully aerobic conditions.

Liu Ye, Advanced Wastewater Management Centre, The University of Queensland, AUSTRALIA (l.ye@uq.edu.au)

Platform Presentations Abstracts

SESSION 2: GREENHOUSE GAS EMISSIONS FROM WATER AND WASTEWATER

Keynote (2): Key factors determining N_2O production by ammonia oxidising bacteria - the known and unknown
M. Pijuan, K. Chandran, M. van Loosdrecht and Z. Yuan

During the last decade, concerns have been increasing regarding the direct nitrous oxide (N_2O) emissions produced in wastewater treatment plants (WWTPs). N_2O is a potent greenhouse gas with a 300-fold greater potential for global warming effects compared with that of carbon dioxide (CO_2). It is mainly produced during the oxidation of ammonia to nitrite by ammonia oxidizing bacteria (AOB) and during the reduction of nitrate or nitrite to nitrogen gas by denitrifying organisms. While this last group produces N_2O as an intermediate product of their metabolism, being able to further reduce it to nitrogen gas, AOBs are believed to produce N_2O as a final product of some of their metabolic processes. Monitoring campaigns carried out in several WWTP have shown that the majority of the N_2O emissions occur in the aerated zones mainly because of the formation of this gas during the nitritation process (oxidation of ammonia to nitrite).

This review focuses on what is known and unknown about the pathways leading to N_2O production in AOB: the nitrifier denitrification pathway and the hydroxylamine oxidation pathway. Also, the effect of several nitrogenous compounds involved in AOB metabolism, such ammonia (NH_3), nitrite (NO_2-), hydroxylamine (NH_2OH) and nitric oxide (NO) as well as the effect of easily controllable process parameters such as dissolved oxygen (DO) and pH on N_2O production will be discussed. Possible mitigation strategies to reduce N_2O emissions from nitrification systems would be presented based on the reviewed studies.

Maite Pijuan, Catalan Institute for Water Research (ICRA), SPAIN (mpijuan@icra.cat)

Identification of N_2O production pathways in biological wastewater treatment based on stable nitrogen isotopes
P. Wunderlin, J. Mohn, M. Kipf, A. M. Lotito, A. Joss, L. Emmenegger and H. Siegrist

The effect of digester liquid addition on dynamics and the level of nitrous oxide (N_2O) emissions from an activated sludge pilot plant was studied in detail. Results show that high nitrogen influent loads lead to higher N_2O emissions compared to 'normal' operation without digester liquid addition. Furthermore, N_2O correlated positively with the build-up of ammonia and nitrite in the oxidation tank. Based on these findings, in combination with the analysis of the intramolecular distribution of ^{15}N in N_2O (called site preference, SP) it can be assumed that nitrifier denitrification by ammonia oxidizing bacteria is the dominant N_2O production pathway under aerobic conditions.

Pascal Wunderlin, Eawag, Swiss Federal Institute of Aquatic Science and Technology, SWITZERLAND (pascal.wunderlin@eawag.ch)

Confounding effect of nitrite on aerobic N_2O production by an enriched ammonia-oxidising
Y. Y. Law, P. Lant and Z. Yuan

The effect of nitrite (NO_2-) on the nitrous oxide (N_2O) production rate of an enriched ammonia-oxidising bacteria (AOB) culture was characterized over a concentration range of 0-1000 mg N/L. The AOB culture was enriched in a nitritation system fed with synthetic anaerobic digester liquor. The N_2O production rate was highest at NO_2- concentration below 50 mg N/L. Further increase in NO_2- from 50-500 mg N/L resulted in a gradual decrease in N_2O production rate and maintained at a low activity between NO_2- concentrations of 500-1000 mg N/L. The suppressive effect of NO_2- was even more apparent at increased dissolved oxygen concentration from 0.55 to 2.30 mg O_2/L.

Yingyu Law, Singapore Centre on Environmental Life Sciences Engineering, Nanyang Technological University, SINGAPORE
(YYLaw@ntu.edu.sg)

Platform Presentations Abstracts

SESSION 3: INDUSTRIAL WATER TREATMENT TECHNOLOGIES - CLOSING THE LOOP

Keynote (1): New challenges and sources for an existing industrial water loop

J. M. C. van Agtmaal and J. W. Mulder

The story outlines the new challenges coming to the regional water loop in the Terneuzen area. This water loop & water treatment scheme was developed by the fact that fresh (surface) water sources are scarce in this area with large scale industrial water consumers.

For over a number of years the effluent streams originating from the industrial and local communal waste water treatment plants are being reused in the Dow Chemical site. The founders of the integrated water loop Dow Chemical Company and Evides Industriewater highly value the cooperation with the local governments, like the local water board. The stakeholders learnt that it is important to cover functional as well as, economic, environmental and sustainable aspects to successfully introduce a water loop scheme. The issued targets for the water loop will become even more challenging driven by company management and the social demand to innovate. For the water loop in the Terneuzen area it means that in the nearby future renewal of treatment technologies will be required to further the water loop integration with new outlined sustainability targets of the companies.

The new sustainability ambitions require also more regional cooperation in order to enhance the water reuse volumes, develop additional water reuse applications, more integration of the water cycles and reduction of the brine volumes. Cooperation is an absolute precondition for success of tomorrows water loop. On top chemical industries requires process water in sufficient volume and various specific qualities to serve all demands in a cost efficient manner. The policy of Dow is to reduce the intake of fresh water for the production of its industrial water. Therefor new sources and technologies will be studied via a research project which is called "E4Water", which started in May 2012 and has a lead time of 4 years. The "E4Water" project targets to develop and test new innovative process technologies and methodologies for further closure of the industrial water loop with an ambition to reduce water and related energy consumption with at least 20%. For the water loop in the Terneuzen area the project targets a total water price of less than €0,40 per m3 to be sufficiently competitive.

Jacobus M. C. van Agtmaal, Evides Industirewater BV., THE NETHERLANDS (j.agtmaal@evides.nl)

Influence of the addition of nanofiltration concentrate on membrane bioreactor performance

C. Kappel, A. Zwijnenburg, H. Temmink, H. Rijnaarts, A. Kemperman and K. Nijmeijer

This work describes the long term treatment of municipal wastewater by a Membrane Bioreactor (MBR), followed by nanofiltration (NF) of the MBR effluent as a tertiary treatment step. This process configurations has several advantages. This work describes the influence of the NF concentrate recycle to the MBR. In the long term, recirculation might cause biological issues as well as changing fouling behaviour.

Christina Kappel, Wetsus, THE NETHERLANDS (christina.kappel@wetsus.nl)

IFAS ANITA™Mox process - A new perspective for advanced N-removal

F. Veuillet, A. Bausseron, E. Gonidec, S. Lacroix, R. Lemaire, M. Christensson, P. Jouaffre and J. Ochoa

ANITA™Mox is a cost- and energy-effective 1-stage deammonification MBBR process developed for autotrophic N-removal (i.e. anammox) and recently implemented in full-scale for Sidestream treatment of N-rich effluent. The high N-removal rate (1.2 kgN/m^3.d) is explained by synergetic interaction in biofilm-carrier between Anammox bacteria (internal biofilm layers) and Ammonia Oxidising Bacteria (AOB) (external layer). This microbial synergy is strongly influenced by transport limitations and substrate availability inside the biofilm which are depend on different environmental factors such as morphology, density and thickness of the biofilm, temperature, substrate concentration (NO_2-, NH_4+, O_2) and shear stress. Therefore, in order to improve the ANITA™Mox process performances under different operating conditions (e.g. Mainstream and Sidestream application), substrate transport must be enhanced. Several studies investigated the effect of combining suspended cultures and fixed biomass into one system called Integrated Fixed-Film Activate Sludge (IFAS) for municipal (Al-Sharekh and Hamoda, 2001; Ødegaard et al., 2000) and industrial (Wessman et al., 2004) wastewater treatment. More specifically, Paul et al., (2006) have reported that a clear spatial distribution of microbial population between floccular biomass (heterotrophs) and fixed biomass (nitrifiers) leads to higher COD and N-removal performances. The objectives of this paper are, (i) to demonstrate the advantages of IFAS configuration for the ANITA™Mox process using comparative lab-scale MBBR and IFAS reactors, (ii) to determine the distribution of the Anammox and AOB bacteria between suspended sludge and biofilm-carrier using molecular and respirometric tools and (iii) to present the first full-scale IFAS ANITA™Mox results for Sidestream treatment and also IFAS Pilot-scale results (0.5m^3) for Mainstream Nremoval after a COD removal stage.

Frederic Veuillet, Veolia Environment Research and Innovation, FRANCE (frederic.veuillet@veolia.com)

Platform Presentations Abstracts

SESSION 3: INDUSTRIAL WATER TREATMENT TECHNOLOGIES - CLOSING THE LOOP

Keynote (2): Hospital wastewater treatment to the next level: removal of micropollutants by MBR, ozone, and GAC
E. Koetse, N. Wortel and M. van Loosdrecht

Decentralized sanitation can be useful when point sources contain specific contaminations. This makes it possible to design cost effective and dedicated treatment options and might generate extra value due to integration at the specific location. The Reinier de Graaf Hospital in Delft has adopted a waste- and wastewater concept (denoted as Pharmafilter) which has two primary components: increasing efficiency and health security in a hospital and an innovative wastewater treatment. Energy is recovered, the quantity of waste is considerably reduced and the wastewater is converted into process water without any trace of micro pollutants. The benefits for patient and nursing staff are Improvement of hygiene and efficiency of hospital processes by using single-use disposables as bed-pans resulting in a positive financial case and less cross contamination in the hospital by reducing the number of contact moments between staff and contaminated waste. The hygienic and medical disposables together with kitchen refuse are removed by means of decentralized shredders and the existing hospital sewerage system. The solids fraction in the waste is fed to an anaerobic digester and the liquid fraction to a treatment plant. The latter consist of a membrane bioreactor, a high flux ozonisation and a granular activated carbon treatment for optimal removal of micro pollutants such as medicines, X-ray fluids and hormone disturbing substances.

The concept was tested in 2008 as a proof-of-principle for the wastewater treatment and digestion component of the total Pharmafilter concept. The digestion of amongst others bioplastic under thermophilic conditions was possible and also analyses of the water phase showed complete removal of all tested micro pollutants. On basis of these tests a full-scale installation has been built which is since 2010 operational in Delft. For the MBR a novel tubular ultrafiltration module with downflow air-scouring was used. This ui=nit showed less fouling and lower energy need then a parallel operated conventional tubular membrane unit. Also the full scale system showed > 99.99 % removal of X-ray contrast fluids, hormone disturbing substances measured as ER-, AR- en GR-Calux and for the traditional compounds such as nitrogen and BOD/COD. Also a full hygienisation was obtained, currently reuse of heat through heat exchangers as well as the water itself are investigated. The costs for decentralised water treatment are compensated by the costs savings related to hospital management, resulting in a net-cost reduction for hospitals upon implementation of the system.

Erwin Koetse, Pharmafilter, THE NETHERLANDS (E.koetse@pharmafilter.nl)

SIBSAC - An integrated system for sediments remediation and high salinity marine wastewaters treatment
G. Di Bella, G. Freni, M. G. Giustra, G. Mancini, V. Notaro, R. Pulvirenti, A. Ticali and G. Venusino

SIBSAC is an industrial scientific project financed by the Italian Government inside the National Operative Program “Research and Competitiveness 2007-2013”. The project aims to identify effective and reliable treatment solutions in order to improve the quality of waters and sediments in harbour areas where frequently high concentrations of xenobiotic compounds are present. The main research and industrial result of the SIBSAC project is the implementation of bench scale and pilot scale plants in order to develop an integrated treatment system for sediments remediation and high salinity marine wastewaters treatment. The present paper describes the project and the results obtained in the first year mainly based on laboratory and field experiments.

Gaetano Di Bella, Università di Enna “Kore”, Facoltà di Ingegneria e Architettura, ITALY (gaetano.dibella@unikore.it)

Suitability of ozone pre-treatment for amoxicillin wastewater
O. Lefebvre, X. Shi, J. G. Tein and H. Y. Ng

This study deals with the ozonation of amoxicillin (AMX) in real pharmaceutical wastewater and its efficacy as a pre-treatment, prior to biological degradation by a mixed culture of bacteria in a sequencing batch reactor (SBR). Strategies for the treatment of AMX pharmaceutical wastewater are provided.

Olivier Lefebvre, Centre for Water Research, Department of Civil and Environmental Engineering, National University of Singapore, SINGAPORE (ceelop@nus.edu.sg)

Platform Presentations Abstracts

SESSION 4: APPLICATIONS OF MOLECULAR MICROBIAL TECHNOLOGIES IN WATER SYSTEMS

Keynote (1): Low-temperature anaerobic digestion for wastewater treatment

V. O'Flaherty

High-rate anaerobic biological treatment technologies are predominantly applied to wastewaters generated by agro-food industries. The rationale for anaerobic treatment is based on the ability of these technologies to handle higher organic loads than aerobic systems, with significantly lower quantities of sludge generation and production of a useable fuel (biogas methane). During these applications, high-rate anaerobic digestion (AD) reactors are operated in the mesophilic (25-37˚C) or thermophilic (45-60˚C) temperature range to ensure optimal microbial activity.

There is great potential for expanding the application range of high-rate AD. For example, the treatment of cold (<20˚C), low-strength, high-volume streams (e.g., many industrial and municipal wastewaters in temperate regions) by AD has, to date, been limited. One reason for this is that, during treatment of dilute wastewaters, the bioenergy harvest (plus additional energy sources) must be expended to heat the system to the optimal high-temperature range. Several challenges must be overcome for successful application of low temperature anaerobic digestion (LTAD). With decreasing temperature: (i) the rate of substrate utilisation may be reduced; (ii) reduced maximum microbial specific growth may be observed; and (iii) methane may become more soluble in the reactor liquor. It is now clear, however, that enhanced methanogenic activity can develop at low temperatures. Newly grown organisms are efficiently retained in the immobilized biomass in high-rate reactors, while the enrichment of methanogenic consortia is also promoted by the very low decay rates (Kd), which prevail at low temperatures. Successful, high-rate, LTAD of sewage and industrial wastewaters (e.g., from the brewery, food-processing and pharmaceutical sectors) has been demonstrated at laboratory- and pilot-scale in long term trials with loading rates of 0.5-20 kg COD m^{-3} day and hydraulic retention times from 1.6 to 48 hours. A holistic approach, which integrates bioprocess, physiological and ecological datasets has been critical to the development of the LTAD concept.

Vincent O'Flaherty, National University of Ireland, IRELAND (vincent.oflaherty@nuigalway.ie)

Microbial characterization of primary colonizers on the membrane surfaces of full-scale MBR plants

G. Matar, S. Bagchi, K. Zhang, D. Oerther and P. Saikaly

Membrane biofouling remains a major challenge in membrane bioreactors (MBRs), but the bacterial community of primary colonizers that initiate fouling is poorly understood. The bacterial community of activated sludge and biofilm samples collected from various full-scale MBR plants was characterized using 16S rRNA gene pyrosequencing. Analysis of 16S pyrosequencing data of membrane biofilms (old and new membranes) showed the predominance of four phyla (Proteobacteria, Bacteroidetes, Actinobacteria and Nitrospira) in all MBR plants. Most importantly, the bacterial community of the membrane biofilm, particularly in the new membranes, was clearly different from the bacterial community present in activated sludge, indicating the development of specialized community on the membranes.

Gerald Matar, Water Desalination and Reuse Research Center, King Abdullah University of Science and Technology, SAUDI ARABIA
(Gerald.Matar@kaust.edu.sa)

Major nitrification and denitrification bacterial communities in activated sludge revealed using combined metagenomic and metatranscriptomic approaches

K. Yu and T. Zhang

The present study applied both metagenomic and metatranscriptomic approaches to characterize microbial structure and gene expression of an activated sludge community. SEED subsystems classification showed that nitrification related genes, comprising only ~1% in DNA dataset but ~6.8% in cDNA dataset, suggested its high relative expression level. Enzyme subunits gene sequences annotation discovered that subunits of ammonia monooxygenase (amoA, amoB, amoC) and hydroxylamine oxygenase had higher expression levels compared with subunits of the other enzymes gene sequences. Further characterization of taxonomic profile of five selected enzymes showed that nitrifying bacteria present were affiliated with Nitrosomonas and Nitrosospira, and, no ammonia oxidizing Archaea was in this AS sample.

Ke Yu, Environmental Biotechnology Laboratory, The University of Hong Kong, HONG KONG, CHINA (yuke@hku.hk)

Platform Presentations Abstracts

SESSION 4: APPLICATIONS OF MOLECULAR MICROBIAL TECHNOLOGIES IN WATER SYSTEMS

Keynote (2): Studying biological drinking water treatment with molecular tools

M. J. Kirisits

Biological drinking water treatment is undergoing a renaissance in the United States, with increased interest in the systematic study of biofiltration. The combination of conventional, bulk measurements and molecular measurements is a powerful means to improve our fundamental understanding of biofiltration. We have used a variety of tools to interrogate biological drinking water processes at the bench-, pilot-, and full-scale, such as 16S rRNA gene pyrosequencing and terminal restriction fragment length polymorphism (T-RFLP) for microbial community analysis; real-time polymerase chain reaction (qPCR) for quantification of key microbial populations or functional genes; environmental scanning electron microscopy with energy dispersive X-ray spectroscopy (ESEM-EDS) for biofilm morphology and elemental composition; measurements of free and bound extracellular polymeric substances (EPS); and measurements of adenosine triphosphate (ATP). For instance, we have found shifts in microbial community diversity and EPS production as a function of nutrient (specifically phosphorus) concentrations in drinking-water biofilters. Several projects (e.g., impact of nutrient limitation on biofiltration, biological arsenic oxidation in biofilters, and gene discovery related to perchlorate reduction) will be used to demonstrate the utility of applying molecular tools to biological drinking water treatment processes.

Mary Jo Kirisits, University of Texas, USA (kirisits@utexas.edu)

Tuning the performance of a natural treatment process using metagenomics for improved trace organic chemical attenuation

J. E. Drewes, D. Li, J. Regnery, M. Alidina, A. Wing and C. Hoppe-Jones

With the help of high-throughput sequencing and metagenomics, this study revealed how the microbial community characteristics including quantity, composition, diversity, as well as functional genes in managed aquifer recharge (MAR) systems can be tuned to enhance removal of chemicals of emerging concern (CECs). Increasing the humic content of the primary substrate resulted in higher microbial diversity. Furthermore, lower primary substrate concentrations and a higher humic content promoted the attenuation of most CECs in laboratory and field MAR systems, and several microbial groups were positively linked with the removal of CECs. Metagenomic results indicated that the metabolic capabilities of xenobiotics biodegradation were significantly promoted for microbiome under carbon starving conditions.

Jörg E. Drewes, NSF Engineering Research Center ReNUWIt, Department of Civil and Environmental Engineering, Colorado School of Mines, USA (jdrewes@mines.edu)

A new approach to assess the real effectiveness of disinfectants and the risk related to stressed bacteria

J. F. Loret, A. Dumont, M. Chabalier, M. Jousset and S. Dukan

An automated microscope coupled with a micro-fluidics system is used to assess the viability of bacteria after application of disinfectants, by measuring the ability of each individual cell to form a micro-colony on agar medium. Comparing the enumeration of L. pneumophila with the standard culture method and the microcolony method after applying increasing doses of chlorine and DBNPA confirms that the reference method largely under-estimates the number of living bacteria. In practice, the Ct factor (concentration x time) should be two or threefold higher to really reach the reduction as estimated with the standard culture method.

Jean-Francois Loret, Suez Environnement, FRANCE (jean-francois.loret@suez-env.com)

Platform Presentations Abstracts

SESSION 5: RESOURCE RECOVERY FROM WASTEWATER

Keynote (1): The carboxylate platform to convert organic materials from wastewater into valuable biochemical

L. T. Angenent, M. T. Agler, S. Ge, J.G. Usack, C. M. Spirito and J. J. Werner

We envision producing medium-chain carboxylic acids from organic wastes with mixed, open cultures of microbial consortia (reactor microbiomes). Our vision is based on the carboxylate platform and combines two fermentation steps into one bioprocess: (1) producing short-chain carboxylic acids from organic wastes; (2) elongating these acids into hydrophobic, extractable medium-chain carboxylic acids. We shaped a reactor microbiome to sequentially elongate short-chain carboxylic acids with 2-carbon units from dilute ethanol in yeast-fermentation beer. Our continuous bioprocess produced n-caproic acid, which is a 6-carbon-chain carboxylic acid that is more valuable than ethanol. No antimicrobials to inhibit methanogens were necessary. In-line product extraction achieved an n-caproic acid production rate exceeding 3.5 grams per liter of reactor volume per day (7.8 grams COD per liter per day), which is comparable to established bioenergy systems with microbiomes. The in-line extraction aided in a product selectivity of ~80% while using a complex substrate. During our ~550-day study, the organic loading rate (OLR), hydraulic retention time, and the extraction system configuration were optimized to improve performance. We achieved an average extraction efficiency of 97%. The significance of this study is to show that a soluble product (n-caproic acid) can be produced with microbiomes continuously over long operating periods at competitive rates using real-world, complex organic wastes. Limited methane production (3.7% of the total carbon) as energy-effective co-product occurred via hydrogenotrophic methanogenesis in the reactor. Others have been able to produce n-caproic acid at higher volumetric rates of ~17 grams per liter of reactor volume per day without in-line extraction but with a synthetic substrate solution of acetic acid and ethanol. The presentation will discuss whether in-line product extraction is necessary.

Largus T. Angenent, Cornell University, USA (la249@cornell.edu)

A novel free nitrous acid (FNA)-based technology for enhancing methane production from waste activated sludge

Q. Wang, L. Ye, G. Jiang, P. Jensen, D. Batstone and Z. Yuan

This study presents a novel free nitrous acid (FNA) – based technology to enhance methane production from waste activated sludge (WAS). The anaerobic degradability of FNA-treated (0.36-2.13 mg N/L, for 24 h) and untreated (0 mg N/L, for 24 h) full-scale WAS were determined by batch biochemical methane potential tests. It was observed that the methane production, hydrolysis rate and degradability of WAS were all enhanced with FNA pre-treatment, indicating anaerobic digestion preceded by FNA pre-treatment could lead to a higher energy/organic substances recovery in the form of methane.

Qilin Wang, Advanced Water Management Centre, The University of Queensland, AUSTRALIA (q.wang9@uq.edu.au)

Protein from WAS as a nutritional supplement in chicken feed

E. M. N. Chirwa and M. T. Lebitso

The amount of protein wasted through sludge in Gauteng, South Africa, amounts to 95,000 metric tonne/yr, with the order of magnitude of the national protein requirement of approximately 145,000 tonne/yr. Waste Activated Sludge (WAS) from wastewater treatment plants treating domestic wastewater contains protein in a ratio of 2:1 against fishmeal. This protein source has not been utilized because of the high content of toxic heavy metals and other potential carcinogenic pollutants in the sludge. In this study, a pretreatment method, modified aqua regia dilute acid wash, was used to lower the metal content by approximately 60%. However, this resulted in 33% loss of amino acids in the acid washed WAS. A feed substitution test in poultry with different fishmeal:sludge ratios (0%, 25%, 50%, 75%, and 100%) showed no impact of sludge SCP on mortality rate. However, sludge substitution in the feed yielded weight gains and cost savings up to 46%.

Evans M. N. Chirwa, Environmental Engineering Group, Department of Chemical Engineering, University of Pretoria, SOUTH AFRICA
(Evans.Chirwa@up.ac.za)

Platform Presentations Abstracts

SESSION 5: RESOURCE RECOVERY FROM WASTEWATER

Keynote (2): Microbial metal recovery: mechanisms and applied potential.
G. M. Gadd

Microbes have a significant influence on many geological and environmental processes, such as the weathering of rocks and minerals, and biogeochemical cycling of the elements. Central to geomicrobiology are transformations of metals, metalloids, radionuclides and related substances, and these are of relevance to pollutant fate in the environment and also biotechnological applications for clean-up, detoxification, recovery and recycling. Our research seeks to understand the mechanisms of metal and mineral biotransformations, and their environmental and applied significance, including biodeterioration. Microorganisms are intimately involved in metal biogeochemistry whether arising from natural environmental sources or anthropogenic activity. Solubilization mechanisms enable removal of metals from wastes and by-products, low-grade ores, and metal-bearing minerals, and are relevant to bioremediation of soil and solid wastes, metal recovery and recycling. Immobilization processes enable metals to be contained and/or transformed into chemically more inert forms. It may also lead to formation of biominerals or metallic elements with catalytic or other properties in nanoparticulate, crystalline or colloidal forms, and these are relevant to development of novel biomaterials for structural, biotechnological, and environmental purposes. Both fungi and bacteria have a variety of useful attributes in these contexts, with increasing current interest due to concerns over environmental contamination and health effects, and the sustainability of metal and mineral resources and the need for improved efforts to recycle and recover strategically-significant elements. This presentation will include examples of fungal and bacterial mechanisms for transformations of metals and minerals, their environmental significance and applications in environmental biotechnology. Topics outlined will include bioleaching, biosorption and bioprecipitation, including fungal processes and metal sulfide bioprecipitation by sulfate-reducing bacteria.

Geoffrey Michael Gadd, Geomicrobiology Group, College of Life Sciences, University of Dundee, UK (g.m.gadd@dundee.ac.uk)

Metal recovery from solutions with a biological sulphide generator
H. Dijkman and M. Olde Weghuis

Metal recovery by sulphide precipitation is a well-known process that is characterised by compact residues and high removal efficiencies. This paper describes a biological process for the safe and cost effective production of sulphide from elemental sulphur. Gaseous H2S is produced on-site and on-demand in an engineered, high rate bioreactor. The gas is recycled through one or multiple contactors to facilitate selective metal recovery from the metal containing effluent. Over two decades of experience in industrial application of the biological sulphur cycle has led to an increase in capacity from 250 kg sulphur to 20 ton sulphur per day.

Henk Dijkman, Paques B.V., THE NETHERLANDS (h.dijkman@paques.nl)

Capturing salinity gradient energy using thermolytic solutions in reverse electrodialysis stacks and catholyte solutions
B. Logan, R. D. Cusick, I. Ivanov, M. Hatzel and F. Zhang

Low grade waste heat (~40-60°C) can be used to produce high and low salinity solutions with thermolytic salts such as ammonium bicarbonate (AmB), which can then be used in reverse electrodialysis (RED) stacks to produce electricity or hydrogen gas. Incorporating the RED stacks into different microbial electrochemical technologies is a new approach for boosting performance of these systems and efficiently capturing salinity gradient energy. It is shown here that with just a single membrane pair power generation is greatly increased in microbial fuel cells when AmB is used as a catholyte. Using an AmB catholyte also facilitates hydrogen evolution from the cathode, allowing for improved performance of microbial electrolysis cells used for hydrogen gas production.

Bruce E. Logan, Penn State University, USA (blogan@psu.edu)

Platform Presentations Abstracts

SESSION 6: STORMWATER COLLECTION, TREATMENT AND RECOVERY TECHNOLOGIES

Keynote (1): Australian stormwater management: from research to implementation

D. McCarthy, A. Deletic, G. Chandrasena and Y. Li

Urban stormwater contains a wide range of constituents which can negatively impact the quality of our urban waterways. Various passive or natural treatment technologies are available to help remove these constituents, including swales, wetlands and biofilters. In Australia, significant government and industry funding has been devoted toward researching biofiltration systems over the past decade; one of the landmark initiatives was the Facility for Advancing Water Biofiltration (FAWB), developed in 2005. FAWB spent four years understanding how biofiltration systems function, optimising them for the removal of constituents which are of concern to ecosystem health (sediments, nutrients and heavy metals). As a result of this research and under guidance from FAWB, local government agencies and land developers could work together to implement successful biofiltration systems across Australia. Various schemes were developed to promote the uptake of biofilters, including the 10,000 Raingardens Program, an initiative which seeks to encourage home owners and local government in Melbourne to install biofilters. More recently, drought conditions in Australia have promoted the adoption of urban stormwater harvesting as an alternate water resource, and biofilters began to be adopted in stormwater harvesting treatment trains. This was even though large knowledge gaps remained about their ability to remove pollutants of concern to human health (in particular pathogens). As such, the Cities as Water Supply Catchment's program, and now the CRC for Water Sensitive Cities, aim to understand and optimise pathogen removal using biofiltration systems. This research has demonstrated that, while existing biofilter designs can achieve excellent pathogen removal under certain operational conditions, their variability in performance remains high. This research also suggests that novel antimicrobial filtration media could be incorporated into the biofilter design to reduce this variability, and hence provide an effective treatment barrier for stormwater harvesting applications.

David McCarthy, Monash University, AUSTRALIA (david.mccarthy@monash.edu)

Forward osmosis for the management of urban runoff in coastal regions

Z. Li, R. Valladares-Linares, M. Abu-Ghdaib and G. Amy

The present study demonstrates a novel osmotic detention pond for the management of urban runoff in coastal areas to achieve a sustainable solution to the water-energy nexus. Forward osmosis (FO) was employed as a bridge to utilize natural osmotic energy from seawater (as the draw solution) for concentrating and reusing urban runoff water (as the feed solution), and as a barrier to reject contaminants. FO flux decline was mainly attributed to the dilution of seawater during a semi-batch process in lab testing. The rejection of trace metals and phosphorus were about 100%. Various changes in urban runoff water did not show significant effects on the rejection of trace metals and phosphorus, but influenced salt leakage (0~2.4%) and the rejection of nitrate (52%~90%) and total nitrogen (65%~85%).

Zhenyu Li, Water Desalination and Reuse Center, King Abdullah University of Science and Technology, SAUDI ARABIA (zhenyu.li@kaust.edu.sa)

Hydrogen sulphide odour control in box culverts/storm drains by iron-based granules

J. L. Sun, C. Shang and G. A. Kikkert

A granular iron-based technology for hydrogen sulphide odour control in box culverts and storm drains is discussed. Embeded iron granules including granular ferric hydroxide (GFH), granular ferric oxide (GFO) and rusted waste iron crust (RWIC) can remove hydrogen sulphide in the sediment phase. The exhausted iron granules are able to be recovered by exposure to dissolved oxygen and the regenerated granular irons can be repeatedly reused. This could be attributable to the oxidation of the iron sulphide film and the formation of new reactive ferric iron surface sites on iron granules. This innovative technology provides a sustainable, long-lasting, cost-effective solution to hydrogen sulphide control in box culverts and storm drains, particularly when waste iron crusts are used.

Jian Liang Sun, Department of Civil and Environmental Engineering, Hong Kong University of Science and Technology, HONG KONG, CHINA (jlsun@ust.hk)

Platform Presentations Abstracts

SESSION 6: STORMWATER COLLECTION, TREATMENT AND RECOVERY TECHNOLOGIES

Keynote (2): Development and improvement of stormwater treatment technologies based on laboratory and numerical investigations with practical applications

J. Schaffner

The treatment of stormwater has been the subject of many investigations, practical and scientific orientated, and offers a large range of different technologies and devices. To give an overview on the large field on treatment technologies the most recent and common ones are summarized and presented briefly. In the following vortex separators and particle separators are examined in more detail. A general description and overview on vortex separators explains the function and the application areas. An overview on the different hydraulic approaches and technologies presents the differences in functionality between vortex separators with mesh screens and without. The results of a research project of the University of Strasbourg are presented to show the possibilities in product development using laboratory measurements and CFD modelling. (Schmitt et al., 2012)
Lamella separators are a technology which is more widely-used for stormwater treatment in recent years in Europe. A general description is given as well as an overview on application areas and different treatment approaches using lamella plates. The focus is placed on the difference of stormwater treatment in a single tank and the treatment of inflow parts in a secondary tank. Results of scientific research projects using CFD modelling of counter and cross flow lamella separators are given to underline the complexity of the created flows in these treatment tanks. The investigations also show the large potential of improvement regarding the cleaning efficiency of lamella plates using the mentioned modelling technologies. (Morin et al., 2008 and 2009) (Vazquez et al., 2010)
A full scale practical application and one of the largest particle separators using lamella plates in Germany is the installation in the Wallenberg Street in the city of Berlin. A brief description of the historical background is given as well as the results of stormwater and sediment measurements in the planning stage of the project. The design of the particle separator, the installation and the treatment procedure show the complexity of the facility. To illustrate the treatment efficiency of the installation the results of a one year monitoring are presented.

Joerg Schaffner, Steinhardt Wassertechnik, GERMANY (joerg.schaffner@steinhardt.de)

The survey of the simpified filtration for CSO control on the full scale plant

S. Ohchi, Y. Nakata, T. Chikusa, M. Takenaka and M. Ide

Water body pollution caused by CSO has been concerned commonly in developed countries. We had carried out two years survey on the full scale SWTP where existed primary settling tank had been modified by Simplified Fiber Filtration (SFF) system. SFF performance shows highly stable against load variety of BOD, SS and hydraulic fluctuation. The total removal ratio of BOD and SS was 75-83%, 72-91%, respectively. Filter media and supporting plate had been free from any clogging.

Sachiko Ohchi, JAPAN (sachiko.oochi@atk-dk.co.jp)

Optimization of urban stormwater depollution using the combination of real-time turbidity measurements and numerical simulations

P. Lalanne, M. Metadier, B. Barillon, T. Polard, G. Binet, C. Kabore and X. Litrico (France)

This paper describes the development of an innovative strategy designed to reduce the pollutants discharge to receiving water from sewer overflow. This strategy is based on the one hand on real-time control of depollution tank with continuous quality measurement and, on the other hand on hydraulic and quality modelling for tank design. The project relied on an intensive data collection campaign conducted on a depollution tank in Bordeaux, France. Turbidity measurements in the tank served as a basis for the recommendation of an efficient quality based real-time management strategy. Supports for an optimized design of a depollution tank were provided on the basis of the results of hydraulic and quality modelling using HYDROPOL software. The results obtained show the high potential of such an innovative sizing - real time combined approach to minimize pollution to receiving bodies.

Patrice Lalanne, Lyonnaise des eaux LyRE, FRANCE (patrice.lalanne@lyonnaise-des-eaux.fr)

Platform Presentations Abstracts

SESSION 7: NUTRIENT REMOVAL AND RECOVERY

Keynote (1): Main stream anammox: current projects and status

S.Murthy, B. Wett and M. van Loosdrecht

The anammox bacteria can autotrophically convert ammonia to nitrogen gas using nitrite as the electron acceptor. The partial oxidation of approximately half of the ammonia to nitrite combined with the oxidation of the remaining ammonia using the anammox process is termed deammonification. Compared to conventional nitrification and denitrification, this partial nitritation by ammonia oxidizing bacteria (AOB) followed by autotrophic denitritation by anammox can result in as much as two-thirds savings in electrical energy needed for aeration and as much as 100% savings in internal or external carbon. This carbon can be redirected to solids process for energy generation.

Deammonification is now being applied to treat concentrated nitrogen sidestreams generated internally during wastewater treatment, including anaerobic digestion filtrate or centrate. It is also being used for concentrated nitrogen streams from industries and for treating leachates. The higher temperature (greater than 30ºC) or higher concentration (greater than 100 mg/L NH_3-N) waste streams allow for more rapid growth of anammox bacteria and repression of nitrite oxidizing bacteria (NOB). The use of deammonification in colder (10 -15ºC) process streams of low strength ammonia-nitrogen (less than 50 mg/L) typically found in mainstream wastewater treatment is more difficult because the inhibition or out-competition of NOB is not always possible. Furthermore, the slow growing anammox bacteria need to be grown or retained at these low mainstream temperatures. Finally, an appropriate COD/N ratio is required to make these reactions possible such that competition from heterotropic organisms is minimized and the carbon can be redirected to energy production.

There are currently large-scale demonstrations of mainstream anammox using several different approaches for anammox growth/retention and NOB out-competition being considered by several research teams. These approaches use suspended growth, biofilm or granular processes for treatment. The presentation will describe the biomass retention options for these approaches as well as the influence of COD, temperature and dissolved oxygen concentrations on these process schemes. Process control options will also be discussed.

Bernhard Wett, ARAconsult GmbH, AUSTRIA (wett@araconsult.at)

Sulfide based denitrification in the SANI process

G.H. Chen, T. W. Hao, J. Qian, H. Lu, H. K. Chui and M. van Loosdrecht

Hong Kong's seawater toilet flushing system not only covers 80% of its inhabitants and saves 20% of freshwater, but also provides sulfate for a sulfur-based biological nitrogen removal process for sewage sludge minimization, namely the Sulfate reduction, Autotrophic denitrification and Nitrification Integrated (SANI®) process. In continental areas where seawater is unavailable, industrial wastewaters, e.g. flue gas desulfurization wastewater, can be used to provide sulfite / sulfate as the electron carrier. This, however, would result in incomplete carbon oxidation, leaving a mixture of sulphide, thiosulfate and organic carbon to enter the anoxic reactor. In this paper, we will report on the lab-scale study of the two denitrification processes: 1) Mixotrophic Denitrification (MD-SANI) – the competitive oxidation of sulphide / thiosulfate (autotrophic denitrification) and organic carbon (heterotrophic denitrification) in a single anoxic reactor; and 2) Autotrophic denitrification (AuD) – the oxidation of sulphide in a granular sludge bed reactor. As compared with the original SANI process, the MD-SANI system appeared to perform better in terms of COD and nitrate removal, and at similar sludge yield (0.028 gVSS/gCOD). For the granular AuD reactor, complete sulfide oxidation and 90% nitrate removal was observed at the HRT of 70 minutes. Granular sludge was developed in 30 days, and stabilized at the size of 400 µm and SVI5 of 35 mL/g.

Guanghao Chen, Department of Civil and Environmental Engineering, The Hong Kong University of Science and Technology, HONG KONG, CHINA (ceghchen@ust.hk)

Comparison of environmental impacts of tertiary filtration technologies for advanced phosphorus removal via Life Cycle Assessment

C. Remy, U. Miehe and B. Lesjean

Different technologies for tertiary wastewater treatment are compared in their environmental impacts with Life Cycle Assessment (LCA). Targeting low phosphorus concentration (50-120 µg/L) and disinfection of WWTP secondary effluent, this LCA compares high-rate sedimentation, microsieve, dual media filtration (all with UV disinfection), and polymer ultrafiltration or ceramic microfiltration membranes for upgrading the large-scale wastewater treatment plant Berlin-Ruhleben. Results show that mean effluent quality of membranes is highest, but at the cost of high electricity and chemicals demand and associated emissions of greenhouse gases (GHG) or other air pollutants. In contrast, gravity-driven treatment processes require less electricity and chemicals, but can reach significant removal of phosphorus. In fact, the latter options will only lead to a minor increase of GHG emissions and energy demand compared to the existing pumping station or UV treatment.

Christian Remy, Berlin Centre of Competence for Water GmbH, GERMANY (christian.remy@kompetenz-wasser.de)

Platform Presentations Abstracts

SESSION 7: NUTRIENT REMOVAL AND RECOVERY

Keynote (2): Assessing extractive nutrient recovery as a viable nutrient control alternative

W. O. Khunjar, R. Latimer, C. Mehta, D. Batstone and S. Jeyanayagam

This paper presents a state of the science review of nutrient recovery technologies with a special emphasis on bridging the knowledge gap currently faced by utilities when considering nutrient recovery for nutrient management. In this paper, we suggest technology classification into accumulation-release-recovery and discuss challenges against and drivers for the implementation of these technologies. We also present an economic evaluation of seven nutrient products that can be recovered using the state of the art technologies.

Wendell O. Khunjar, Hazen and Sawyer P.C., USA (wkhunjar@hazenandsawyer.com)

Microalgae-based treatment as an alternative for removing nitrogen and phosphorus from WWTP effluents

L. Lacoste, B. Barillon, L. Constans, A. Huyard, C. Peregrina and S. M. Ruel

The application of microalgae as secondary and sidestream treatments was investigated in a photobioreactor (PBR) at laboratory scale. Microalgae-based treatment processes appeared more efficient when applied on concentrated sidestreams. However, this effluent must not be too concentrated as highlighted by the PBR experiments: a concentration of 50-350 $mgNH_4\text{-}N.L^{-1}$ appeared favourable for microalgae development over bacteria. The removal kinetics obtained by the studied microalgae technologies were relatively poor when compared to conventional treatments. Besides, microalgae-based processes offer additional advantages such as phosphorus assimilation, lower aeration demand, CO2 elimination and potential for biomass valorisation.

Luc Lacoste, Suez Environnement, FRANCE (luc.lacoste@suez-env.com)

Full scale recovery of nitrogen from ammonia rich sludge liquid and urine for the production of fertilizer by full scale air or membrane stripping

M. A. Boehler, M. Schachtler, J. Mohn, A. Heisele, W. Kunst, C. Liebi, S. Zulegg and H. Siegrist

In the last 50 years the production of artificial nitrogen fertilizers exploded and lead to an increasing pollution of water bodies and the atmosphere. There are efforts reduce this environmental nitrogen load, as for example the EU directive 91/676/EWG of the European Commission from 1991, which has the aim to protect water bodies and to reduce nitrate emissions.

Furthermore phosphorus is an essential fertilizer for high performance agriculture and high quality phosphorus resources will run out in the near future. In addition Europe has a strong dependency on import of this fertilizer. In this context, efficient technologies for nutrients recovery out of wastewater and urine will get more and more attention in the coming future.

The production of nitrogen fertilizer via Haber-Bosch process and the elimination of the nitrogen in wastewater treatment plants (WWTP) by nitrification and denitrification are costly and energy consuming. Biological nitrogen removal destroys the inorganic nitrogen but parallel a fraction of the nitrogen is transformed into the very strong greenhouse gas nitrous oxide.

In recent years more and more WWTPs are equipped with facilities for the pre-treatment of ammonia rich supernatant, to reduce the internal N-load of the water lane of the WWTP. Additionally up to date there are no energy and cost effective techniques for phosphorus recovery if the sewage sludge is banned for agricultural use.

The paper will present two technologies, which have been substantially upgraded, adapted and optimised for an efficient recovery of nutrients out of sludge liquid and urine transforming into a highly concentrated nitrogen liquid fertilizer free of any micro-pollutants for agricultural use. The novel processes will also be discussed under aspects like energy consumption, costs and operational handling compared to other N-removal technologies in WWTP's.

Marc A. Boehler, Eawag, Swiss Federal Institute of Aquatic Science and Technology, SWITZERLAND (marc.boehler@eawag.ch)

Platform Presentations Abstracts

SESSION 8: ADVANCED OXIDATION – NEW TECHNOLOGIES AND APPLICATIONS

Keynote (1): Micropollutant control by ozonation in urban wastewaters: AOP performances and key considerations

S. Baig and S. Besnault

The generic term "organic micropollutants" includes a wide range of water contaminants: biogenic hormones, pharmaceuticals and personal care products (PPCP), pesticides, flame retardants, detergents, veterinary drugs, industrial chemicals and their metabolites and by-products. More than 50,000 are in current uses nowadays and hundreds enter the market every year. Some of them are persistent in the environment due to their low biodegradability and low photosensitivity. Their occurrence made arise two main concerns; the negative impact they have in the biota, specially the hormonally active compounds, and the contamination of the water bodies used for food production as well as for water potabilization and industry usage. Many national surveys pointed out that urban wastewater treatment plants (WWTP) as major emission sources of such microcontaminants.

Wastewater treatment plants can eliminate part of the micropollutants detected in the inlet water (Choubert et al., 2010). However, some micropollutants remain in treated water at the outlet of the plants. To reach values compatible with a good status of the water bodies, existing processes can be upgraded and additional advanced treatments can be implemented. Among them, ozonation and advanced oxidation processes (AOPs) seem to be the most appropriated technologies (Ikehata, 2008). They do not produce concentrated wastes, such as sludge or spent adsorption media, which obviously require a further and proper management. Lab- and full-scale studies demonstrate that ozone application is a very promising solution. Ozone doses above the initial ozone demand (IOD) were shown suitable for removing recalcitrant substances (Wert, 2009).

Moreover, the Advanced Oxidation Processes (AOPs) are characterized by common principle and goal of creating an extremely powerful oxidant, mainly the hydroxyl radical in order to obtain high removal efficiencies for pollutants resistant to conventional oxidation (Glaze, 1987; Hoigné, 1988). Although known for more than twenty years for some of them that combines ozone, UV radiation and hydrogen peroxide, they are currently receiving renewed interest for enhanced removal of micropollutants. The removal efficiencies provided by AOPs were mainly investigated at lab-scale and really scarcely at larger scale.

The extent of the scope and complexity of the oxidation processes require a real implementation of a process engineering approach to make them the most efficient and therefore technically and economically viable.

Therefore, the present study reviews and further investigates the removal of a broad range of organic micropollutants by ozonation and other Advanced Oxidation Processes at lab and pilot scale under controlled conditions with the aim to evaluate and to compare the oxidation performances. Special emphasis is made on the suitable approach for their next application at full scale by considering the related key process and chemical parameters. This approach is further described in the case of ozonation that involves aspects related to kinetics, mass transfer and hydrodynamics [Roustan, 2000].

Sylvie Baig, Degremont, FRANCE (sylvie.baig@degremont.com)

A novel advanced oxidation method for simultaneous disinfection and removal of organic micropollutants in wastewaters

T. Karpova, J. Ekman, E. Melin and A. Vuori

Some organic trace contaminants can cause harmful effects on living organisms. Conventional wastewater treatment systems can partially remove some of these organic micropollutants (OMPs). However, large portion of these OMPs are released into the environment. Thus, advanced treatment methods are needed to reduce the level of OMPs in the discharge waters. Such solutions should be environmentally friendly and cost-effective to be implemented. A novel advanced oxidation method based on a combination of performic acid (PFA) and ultraviolet (UV) radiation is proposed for simultaneous wastewater disinfection and decomposition of OMPs. The PFA/UV combination exhibited a clear synergy effect in the oxidation of selected OMPs. Besides, an almost complete elimination of indicator microorganisms has been simultaneously achieved.

Tatjana Karpova, Kemira Oyj, FINLAND (tatjana.karpova@kemira.com)

Enzymatic reactors as tertiary treatment for oxidation of Endocrine Disrupting Compounds (EDCs)

G. Eibes, L. Lloret, R. Taboada-Puig, A. Arca- Ramos, C. Martínez-Patiño, M.T. Moreira, G. Feijoo and J.M. Lema

Enzymatic-mediated oxidation of selected endocrine disrupting compounds (EDCs) Estrone, Estradiol, Ethinylestradiol, Bisphenol A and Triclosan found in the aquatic environment has been assessed in batch experiments. The influence of the source of the enzyme (laccase), pH and the presence of 1- hydroxybenzotriazole as laccase mediator were evaluated. Then, an enzymatic membrane reactor (EMR) was applied to continuously remove estrogens found in sewage effluents. The EMR allowed nearly complete elimination of estrogens from real wastewaters at environmental concentrations. These results open this technology as a potential strategy for the tertiary treatment of EDCs and micropollutants in general.

Gemma Eibes, Department of Chemical Engineering, Institute of Technological Research, University of Santiago de Compostela, SPAIN
(gemma.eibes@usc.es)

Platform Presentations Abstracts

Impact of ferrate treatment on natural organic matter

D. Reckhow, J. E. Tobiason, Y. Jiang and J. Goodwill

The objective of this study was to characterize the impacts of ferrate treatment on the organic matrix of a group of raw drinking waters. This was intended to provide guidance on the overall impacts of integrating ferrate into full-scale water treatment.

David A. Reckhow, Department of Civil & Environmental Engineering, University of Massachusetts, USA (reckhow@ecs.umass.edu)

Metal oxides enhanced bromate formation during chlorination of bromide-containing waters in distribution systems

C. Liu and J. P. Croue

Bromate formation from the reaction between chlorine and bromide in homogeneous solution is a slow process. The present study investigated metal oxides enhanced bromate formation during chlorination of bromide-containing waters. Due to the ability to catalyze HOBr disproportionation, bromate was formed during chlorination of bromide-containing waters in the presence of CuO and NiO, whereas no bromate was detected in the presence of C Cu_2O and α-FeOOH for analogous conditions. The inhibition ability of coexisting anions on bromate formation at pH 8.6 follows the sequence of phosphate >> sulfate > bicarbonate/carbonate. A black deposit of water pipe harvested from a drinking water distribution system exerted significant residual oxidant decay and bromate formation during chlorination of bromide-containing waters. Energy dispersive spectroscopy (EDS) analyses showed that the black deposit contained significant copper (14%, atomic percentage) and nickel (1.8%, atomic percentage). Cupric oxide was further confirmed by X-ray diffraction (XRD). These results indicate that bromate formation may be of concern during chlorination of bromide-containing waters in distribution systems containing CuO and/or NiO corrosion products.

Chao Liu, Water Desalination and Reuse Center, King Abdullah University of Science and Technology, SAUDI ARABIA (chao.liu@kaust.edu.sa)

Mitigation of I-DBPs and control of bromate formation during ozonation pre-treatment

S. Allard, C. Nottle, A. Chan, C. Joll, J. Charrois and U. von Gunten

Iodinated disinfection by-products (I-DBPs) are generally more genotoxic and cytotoxic than their regulated chlorinated and brominated analogues. Here, we report that using an ozonation process results in the conversion of iodide to iodate, which reduced the formation of I-DBPs. However, the use of ozone in Br-containing waters has been restricted due to the potential of forming bromate. Experiments carried out using different water matrixes and various ozone doses show that iodide can be selectively oxidised to iodate, whilst ensuring the bromate formation remains below the guideline value (10 µg L-1). Lowering the pH also produces a similar iodide to iodate conversion whilst reducing bromate formation. Finally, as additional benefit of ozonation is its potential to oxidises I-THMs if already present in waters.

Sebastien Allard, Curtin Water Quality Research Centre, Department of Chemistry, Curtin University, AUSTRALIA (s.allard@curtin.edu.au)

Impact of chlorine on assimilable organic carbon in water treatment

M. J. Stefan and S. Sarathy

Assimilable organic carbon is formed as a byproduct of dissolved organic matter reactions with oxidative species generated through advanced oxidation processes. Chlorination of UV/H_2O_2-treated water as well as UV/H_2O_2-BAC treated water reduced the AOC levels formed during the oxidation process. No increase in DBPs was observed which could correlate to the decrease in AOC. Hydrolysis of highly chlorinated low-molecular weight aldehydes to inorganic compounds may explain the chlorine effect on formed AOC.

Mihaela I. Stefan, Trojan Technologies, CANADA (mstefan@trojanuv.com)

the international water association

Leading-Edge Technology

10th IWA Leading Edge Conference on Water and Wastewater Technologies

Poster Presentations Listing

Poster Presentations Listing

THEME 1: INNOVATIVE DESIGN, OPERATION, AND ROBUSTNESS OF MEMBRANE SYSTEMS FOR WATER AND WASTEWATER PROCESSES

101 Selection of optimal draw solutions for forward osmosis based on their fundamental properties
M. Arnaldos, T. de la Torre, C. Rodriguez, J. J. Malfeito (SPAIN)

102 Innovative strategies for energy optimisation in Membrane Bioreactors
B. Barillon, S. M. Ruel, C. Langlais, V. Lazarova, P. Dauthuille (FRANCE)

103 Alginate Fouling of the Functionalized Carbon Nanotube Blended Membranes for Forward Osmosis
H. G. Choi, H. Park, M. Son, S. H. Yoon, H. Choi (KOREA)

104 Operation of Biofilm-MBR systems: a critical evaluation of different treatment schemes and comparison with a conventional MBR
T. de la Torre, C. Rodriguez, M. A. Gomez, E. Alonso, J. L. Santos, J. I. Perez, J. J. Malfeito (SPAIN)

105 Spacer filament approach: a possible way to simulate the full scale of RO membrane sheet
W. Ding, N. Siebdrath, W. Uhl (GERMANY)

106 Direct ultrafiltration for complex surface water treatment enhanced by in-tank/in-line microcoagulation
O. Ferrer, B. Blankert, A. Bobe, C. Galvan, J. Mesa, O. Gibert, X. Bernat (SPAIN)

107 Fouling behaviour of secondary effluents in ultrafiltration and the influence of different pretreatments
M. Godehardt, A. Patel, M. Jekel (GERMANY)

108 Chemical Oxygen Demand (COD) monitoring of MBR using 2D Fluorescence data and Projection to Latent Structures (PLS) method
S. Gupta, S. Ramanathan, H. Lohokare, V. Sivaswamy (INDIA)

109 Clofibric acid and gemfibrozil removal in bioreactors with submerged membranes
T. Gutierrez Macias, P. Mijaylova Nacheva (MEXICO)

110 Management of groundwater pollution by Perchlorates salts
C. Helmer, A. Zuluaga, Z. Reddad, N. Castel, R. Bonnard, C. Anselme, S. Royer (FRANCE)

111 Assessment of biofilter and submerged membrane adsorption bioreactor pretreatment using rapid assimilable organic carbon test
S. Jeong, G. Naidu, S. Vigneswaran, J. Kandasamy, R. Ben Aim, S. Rice (AUSTRALIA)

112 AiRO; direct Reverse Osmosis on surface water
R. Jong, J. A. de Ruijter, J. Q. J. C. Verberk, W. G. J. van de Meer (THE NETHERLANDS)

113 Direct Treatment of Surface Water with Novel Hollow Fiber Nanofiltration
A. Keucken, F. J. Spenkelink (SWEDEN)

114 Innovative RO Membrane Technologies for water and wastewater processes
M. Kimura, K. Nakatsuji, T. Sasaki, M. Henmi (JAPAN)

115 PES Membrane Performance for TEG Removal of Wastewater from Natural Gas Processing Plant
S. Larpkiattaworn (THAILAND)

116 Hydrogen and Oxygen Production from Wastewater treated with Ultrafiltration and Membrane Distillation
E. Marzo Adam, A. Gali Serra, B. Lefevre, L. Bouchy, A. Vidal, A. Fabre, S. Besnault (SPAIN)

117 The effect of using UF as pretreatment in RO membranes for biofouling controlling when brine recycling
O. A. Mohammed, H. W. Abdulmageed, W. Al-Kinani (IRAQ)

118 Modelling the long-term evolution of permeability in full-scale municipal MBRs: a multivariate statistical approach
N. Philippe, Y. Racault, A.E. Stricker, M. Sperandio, P. A. Vanrolleghem (FRANCE)

119 Energy Assessment of a SBR/MBR Treating Domestic Wastewater for Tailored Reuse in Urban Irrigation
A. Prieto, R. Holloway, D. Vuono, T. Cath, T. Reid, L. Johnson, J. Drewes (USA)

120 Controlling the Reduction of Multiple Electron Acceptors in the H2-Based Membrane Biofilm Reactor
B. E. Rittmann, A. Ontiveros-Valencia, H. P. Zhang, Y. Tang, B. O. Kim, R. Krajmalnik-Brown, D. Friese, P. Evans (USA)

Poster Presentations Listing

THEME 1: INNOVATIVE DESIGN, OPERATION, AND ROBUSTNESS OF MEMBRANE SYSTEMS FOR WATER AND WASTEWATER PROCESSES

121 Separation of biofilm solids from MBBRs using Salsnes Filter
A. K. Sahu, H. Q. Ng, T. Bilstad, B. Rusten (NORWAY)

122 Enhanced backwash of ultrafiltration with high concentration NaCl and KCl
R. Shang, S. G. J. Heijman, L. C. Rietveld (THE NETHERLANDS)

123 Treatment of antibiotic wastewater in a pilot scale MBR-NF system at high water yield
J. X. Wang, Y. S. Wei, K. Li, Y. T. Cheng (CHINA)

124 Microbial osmotic fuel cells - towards energy-neutral wastewater treatment and seawater desalination
C. Werner, B. Logan, P. Saikaly, G. Amy (SAUDI ARABIA)

THEME 2: GREENHOUSE GAS EMISSIONS FROM WATER AND WASTEWATER SYSTEMS

201 Dynamics of N2O emission from partial nitritation-anammox in a full-scale granular sludge reactor
C. M. Castro Barros, M. Daelman, K. Mampaey, M. van Loosdrecht, E. Volcke (BELGIUM)

202 Carbon Footprint of Wastewater Treatment Systems in China
C. Chai, Y. Feng, D. Zhang, C. Li, X. Zhou (CHINA)

203 Spatial and temporal distribution of synthetic musks in water of the Songhua River in north-eastern China
Y. Feng, B. Lu, P. Gao, Z. Zhang (CHINA)

204 Carbon Footprint of Wastewater Treatment Systems in China
Y. Feng, C. Chai, D. Zhang, C. Li, X. Zhou (CHINA)

205 Carbon Reduction Through Innovation & Technology: An International Perspective
A. Koodie, A. Shaw, S. H. Koh, S. Tarallo (UK)

206 Fossil organic carbon in wastewater and its fate in treatment plants
Y. Law, G. A. Jacobsen, A. M. Smith, Z. Yuan, P. Lant (AUSTRALIA)

207 Reconsideration of the methodology to evaluate CH4 and N2O emissions from sewage treatment plants
S. Masuda, I. Sano, S. Suzuki, Y. Y. Li, O. Nishimura (JAPAN)

208 Sewerage Plan for the Prevention of Global Warming in Tokyo ~Earth Plan-2010~
Y. Nihei, H. Takahashi, K. Katou (JAPAN)

209 MiNzE - A technology for minimization of nitrous oxide emissions from biological treatment of ammonium-rich wastewater
K. H. Rosenwinkel, M. Beier, Y. Schneider (GERMANY)

210 Sustainable Low Energy Disinfection With Pasteurization. Full Scale Demonstration Testing Results in California
A. Salveson, D. Pfeifer, J. Willis, G. Ryan (USA)

211 Achieving Significant GHG Reductions and Positive Net Energy Balance at a BNR Treatment Facility
J. Sandino, P. H. Nielsen, D. Whitlock, T. Johnson, M. Leth, M. Nielsen, T. Jensen (USA)

212 Nitrous oxide emissions during reject wastewater treatment via partial nitrification: effect of process control and operation mode
J. Tora , M. Pijuan, A. Rodriguez-Caballero, J. Carrera, J. Perez (SPAIN)

Poster Presentations Listing

THEME 3: INDUSTRIAL WATER TREATMENT TECHNOLOGIES - CLOSING THE LOOP

301 Desalination by a solar, thermally driven distillation process
K. G. Barr, I. Mackinnon (AUSTRALIA)

302 Desorption study for the development of a process combining adsorption on activated carbon and biological oxidation
S. Bourneuf, C. Albasi, A. Triger, N. Lesage, M. H. Manero (FRANCE)

303 Optimization of coagulation/flocculation for COD and TOC removal from slops: performance analysis with low coagulant dose
G. Di Bella, M. G. Giustra, V. Notaro, G. Mancini, S. Cimino, A. Pucci, G. Freni (ITALY)

304 Ecotoxicity removal from industrial wastewater
J. Dries, L. Geuens, R. Blust (BELGIUM)

305 On-line control of an industrial SBR
J. Dries, D. Daens, L. Geuens (BELGIUM)

306 Coupling advanced chemical and biological technologies for extremely high contaminated mature landfill leachate
J. Gabarro, A. Anfruns, S. Puig, R. Gonzalez-Olmos, X. Mora, M. Ruscalleda, M. Balaguer, J. Colprim (SPAIN)

307 The risks in ErP regulations for wastewater pumps
S. Gerlach, K. Hoechel, P. U. Thamsen, F. Ennenbach, F. Kluetsch (GERMANY)

308 APTMS-modified mesoporous silica MCM-41 for dye removal
J. K. Kang, C. G. Lee, J. A. Park, S. Y. Yoon, S. B. Kim (KOREA)

309 Which antiscalant to control fouling of the nanofiltration membranes in Choisy-le-Roi Drinking Water Treatment Plant?
K. Kecili, C. Marconnet, C. Feliers, A. Lang (FRANCE)

310 Simulation Material Modelling of Biofilm Mechanical Properties
C. S. Laspidou, L. Spyrou, N. Aravas, B. E. Rittmann (GREECE)

311 High nitrogen laden wastewater in the presence of organics: implications on aerobic granular sludge
H. R. Mackey, T. Hao, G. R. Morito, G. H. Chen (HONG KONG, CHINA)

312 Effect of green coagulants in advanced pre-treatment stage towards a positive energy wastewater treatment plant approach
A. Manas, C. Simon, S. Chastrusse, F. Vedrenne, R. Lestienne, G. Delaisse, J. Ochoa (FRANCE)

313 After “hard treatment”, “soft treatment” in sewage treatment: case of buffer zones: field observations and behavior of micropollutants
C. Pagotto, D. Boris (FRANCE)

314 Potential TDS Removal for Wastewater from Petroleum-Based Industry
R. Rattanaoudom, C. Eamchotchawalit, S. Larpkiattaworn, J. Pannoi, K. Keawsupsa, J. Lumpan (THAILAND)

315 Application of iron nanoparticles for wastewater treatment
O. Skorvan, J. Matysikova, M. Holba (CZECH REPUBLIC)

316 Influence of activated carbon surface characteristics on the removal of hydroxybenzothiazole from waters
H. Valdes, C. A. Zaror (CHILE)

317 Modelling chlorine disinfection for fresh-cut lettuce wash water processes
S. van Haute, I. Sampers, K. Holvoet, M. Uyttendaele (BELGIUM)

319 Low temperature nano/ submicron tourmaline enhanced biological aniline wastewater treatment feasibility study
L. Wei, T. W. Hao, C. Y. Li, G. H. Chen (CHINA)

320 Reducing fresh water consumption in high water volume consuming industries by recycling AOP-treated effluent
A. Wilmot (BELGIUM)

321 Photo-oxidation of EPA priority 16 polycyclic aromatic hydrocarbons (PAHs) in produced water
J. Zheng, B. Zhang, B. Liu, B. Chen (CANADA)

Poster Presentations Listing

THEME 4: APPLICATION OF MOLECULAR MICROBIAL TECHNOLOGIES IN WATER SYSTEMS

401 Revealing Filamentous Bacteria Community in Activated Sludge by Ion Torrent Sequencing
C. Cao, I. Lou, M. Y. Lee, N. M. Ho (MACAO, CHINA)

402 Biological Cr(VI) Immobilisation in Saturated Aquifer Zone Using Culture Inoculated Soil Columns
E. M. N. Chirwa, I. Venter, H. Wienand (SOUTH AFRICA)

403 Microbial community structure and diversity in a tannery wastewater treatment plant
A. F. Desta, F. Assefa, S. Leta, F. Stomeo, M. Wamalwa, D. Appolinaire (ETHIOPIA)

404 Changing-parameter-driven microbial evenness fluctuation leads to biofouling acceleration
D. Gao, Y. Tao (CHINA)

405 Metagenomic profiling of seasonal microbial dynamics in activated sludge of a full-scale wastewater treatment plant
F. Ju, T. Zhang (HONG KONG, CHINA)

406 Viruses monitoring from the source to the drinking water
C. Lecarpentier, C. Feliers, A. Lang (FRANCE)

407 Microbial Fuel Cell Based Toxicity Biosensor for Detection of Zn(II) and Ni(II) in Wastewater
Y. Shen, H. Y. Ng (SINGAPORE)

408 Recent progress on Aerobic Granular Sludge process
M. Sperandio, H. Hauduc, G. Hernandez, F. Decker, Y. Bessiere (FRANCE)

Poster Presentations Listing

THEME 5: RESOURCE RECOVERY FROM WASTEWATER

501 Energy Recovery from Biosolids using Gasification
J. Brown (USA)

502 Innovative Approach using GC-GC-TOF for identification of organic inhibitors of energy recovery from waste water
A. L. Bruchet, N. Noyon, Z. Doquang, P. Camacho, H. van den Bossche (FRANCE)

503 Crude glycerol as substrate for bioplastics production by bacterial enrichments
C. M. Castro-Barros, H. Moralejo-Garate, J. L. Campos, R. Kleerebezem, M. van Loosdrecht, A. Mosquera-Corral (SPAIN)

504 Bioelectrochemical ammonia recovery and high-purity hydrogen production from synthetic municipal wastewater
K. Y. Cheng, R. Cord-Ruwisch, A. H. Kaksonen (AUSTRALIA)

505 Lipids in Municipal and Industrial Wastewaters
E. Efimova, J. M. Marjakangas, A. M. Lakaniemi, P. Koskinen, J. Puhakka (FINLAND)

506 Energy coupling system for sulfur and recovery from Sulfate wastewater
Y. Feng, J. Liu, W. He, Y. Gong (CHINA)

507 Energy-oriented utilization of Corn Stover Using Electrochemical Microbial Anaerobic Systems
Y. Feng, W. He, X. Wang, J. Liu (CHINA)

508 Direct recovery of energy from urine using stainless steel mesh air-cathode MFCs
Y. Feng, X. Zhou, Y. Dong (CHINA)

509 Treatment of Process Water from Hydrothermal Carbonization of Organic Waste
J. Fettig, H. Liebe (GERMANY)

510 Closing the loop - Strategies for Resource Management in Cities of the Future
S. Jeyanayagam, R. Latimer, W. O. Khunjar (USA)

511 Advanced Dynamic Modeling of Linked Control, Air, Hydraulic and Wastewater Process Systems
B. R. Johnson, B. Price, I. Takacs, J. Thorpe (USA)

512 TiO2/CuO Nanofibers for Clean Water and H2 Cogeneration from Wastewater
S. S. Lee, H. W. Bai, Z. Y. Liu, D. D. Sun (SINGAPORE)

513 High propionic acid production from sewage sludge and food waste
X. Li, Y. Chen, X. Zheng, J. Luo (CHINA)

514 Recovery of ferric iron from ferrous sulfide particles generated from precipitation sludge
E. Mejia Likosova, Y. Poussade, A. Roux, J. Keller, S. Freguia (AUSTRALIA)

515 Integrating bioelectrochemical systems with anaerobic digestion
O. Modin (SWEDEN)

516 Residual yeast degradation for laccases production by the action of Pycnoporus sanguineus fungus
A. L. Parra-Guardado, M. Renteria-Hernandez, D. Possidenti-Meira, V. Castaneda, K. Rossano-Guerrero, J. Martinez-Corona, D. L. Cardenas-Chavez, R. Parra-Saldivar (MEXICO)

517 Waste products as inexpensive media for laccase production by Pycnoporus sanguineus: tobacco, banana peel and Remazol Brilliant Blue R
M. Rodriguez, D. Cardenas, R. Parra (MEXICO)

518 Recovering Microalgae Using a Salsnes Filter
A. K. Sahu, H. Bedoya, T. Wesche, B. Rusten (NORWAY)

519 Model Water for the Aerobic Biological Treatment of Black Water
N. Scheyer, M. Wagner, P. Cornel (GERMANY)

520 Water Reuse - MBBR/IFAS provides Enhanced Removal Efficiency and increased Treatment capacity without increasing carbon footprint for upgrading WWTP
A. Ud Din (UAE)

522 Hydrolytic enzymatic activity on anaerobic digestion of waste activated sludge with food waste addition
Y. M. Yun, D. H. Kim, K. W. Jung, H. S. Shin (KOREA)

Poster Presentations Listing

THEME 6: STORMWATER COLLECTION, TREATMENT AND RECOVERY TECHNOLOGIES

601 Real time control of the Louis Fargue catchment in Bordeaux: first operational results
G. Andrea, M. Ahyerre (FRANCE)

602 Impact of urban drainage systems discharges on receiving bodies: towards a more sustainable management
B. Barillon, S. Martin Ruel, M. Coquery, J. L. Bertrand-Krajewski, P. Dauthuille (FRANCE)

603 Treatment of rainwater runoff in recovery and recycling companies
M. Chys, V. Depuydt, E. Blondeel, S. Hugelier, S. W. H. van Hulle (BELGIUM)

604 Impact of wastewater discharge from the city of Bordeaux on summer oxygenation of the Garonne tidal River
A. Lanoux, H. Etcheber, A. Sottolichio, S. Schmidt, M. Chambolle, X. Litrico, G. Abril (FRANCE)

605 Low impact development technologies for stormwater management in urban development site
S. Y. Lee, M. Maniquiz-Redillas, J. Y. Choi, J. S. Hong, F. K. Geronimo, J. M. Mercado, J. A. Tobio, L. H. Kim (KOREA)

606 Constructed wetlands for stormwater treatment in the UK: a review and comparison with the rest of the world
R. Lucas, E. Earl, A. O. Babatunde, B. N. Bockelmann-Evans, V. Samaras (UK)

607 Design and performance assessment of novel integrated constructed wetland systems for stormwater treatment and storage
R. Lucas, E. Earl, A. Babatunde, B. Bockelmann-Evans, V. Samaras (UK)

608 Technological alternative of a system to save water and fertilizers based in a super-absorbent polymer for cultivation in arid regions of Mexico
M. A. Mendoza-Suarez, A. I. Ramirez, S. A. Galaz, R. Salmon-Folgueras, D. Cardenas, R. Parra (MEXICO)

609 Effects of different weather conditions and parameters on solar based disinfection of Pseudomonas aeruginosa in stored rainwater
M. Nawaz, M. Amin, M. Y. Han, A. Alazba, U. Manzoor (SAUDI ARABIA)

610 Water Framework Directive: proposition of a method to involve stakeholders in actions and decision process
A. Tourne, J. P. Rousseau, C. Darribere, M. Chambolle, F. Cherqui, D. Granger, P. Le Gauffre, B. Loubiere (FRANCE)

Poster Presentations Listing

THEME 7: NUTRIENT REMOVAL AND RECOVERY

701 Respirometric assessment of nitrification inhibition in a municipal wastewater treatment plant with industrial input
F. Cecen, A. G. Geyik (TURKEY)

702 The SND process in two granular sequencing batch reactors with different mean granule sizes: a case study
G. Di Bella, M. Torregrossa (ITALY)

703 Granulation of Autotrophic Denitrifying Sludge in SANIÂ® Process
T. Hao, J. Luo, L. Wei, H. Lu, H. K. Chui, M. van Loosdrecht, G. H. Chen (HONG KONG, CHINA)

704 Can ultrasonically disintegrated activated sludge be exploited as an internal carbon source for denitrification?
N. Lambert, I. Smets, J. van Impe, R. Dewil (BELGIUM)

705 Assessing new ways to manage WWTP using optimisation
R. Lestienne, P. Mandel, S. Worbe, C. Amiel, J. C. Ochoa (FRANCE)

706 Pyrite driven autotrophic denitrification – a novel way to simultaneously remove N and P from wastewater without biodegradable organic matter
R. Li, Y. Yuan, L. Xiao, X. Zhan, A. Li (CHINA)

707 Nitrogen and phosphorus removal from wastewater in a novel onsite bio-eco combined system
H. Liang, X. Guo, J. Liu (CHINA)

708 Upgrading Coagulation/ Filtration by Activated Carbon Adsorption for Combined P and Organic Micropollutant Removal
F. Meinel, A. Sperlich, A. S. Ruhl, F. Zietzschmann, R. Gnirss, M. Jekel (GERMANY)

709 Novel Activated Sludge Pressurized SBR for Urine Nitrification
G. R. Morito, H. R. Mackey, J. Luo, G. H. Chen (HONG KONG, CHINA)

710 Spidflow: VEOLIA high speed floatation
D. Pastorelli, A. Gaid (FRANCE)

711 Effect of particulate organic fractions on denitrification rates using Salsnes Filter fine mesh sieves for primary treatment
V. A. Razafimanantsoa, A. Sahu, T. Bilstad, B. Rusten (NORWAY)

712 Utilizing modified bone charcoal with Ferric as low-cost sorbent for phosphorous removal from aqueous solution
M. Tahghighi Haji Alizadeh, M. Taghi Ghaneian, O. Anvari (REPUBLIC OF IRAN)

713 Removal of ammonia in a Modified Ludzack-Ettinger SMBR treating oil refinery wastewater
C. G. Veronese, L. L. Beal, V. M. Junqueira Santiago, A. C. Cerqueira, A. P. Torres (BRAZIL)

Poster Presentations Listing

THEME 8: ADVANCED OXIDATION - NEW TECHNOLOGIES AND APPLICATIONS

801 Advanced oxidation of organic matter in natural waters with TiO2 immobilized films
T. Amorim, S. F. Silva, T. Linhares, C. Tavares, A. Duarte (PORTUGAL)

802 Comparison of ozone and HO* induced conversion of effluent organic matter (EfOM) using ozonation and UV/H2O2 treatment
W. T. M. Audenaert, D. Vandierendonck, S. W. H. van Hulle, I. Nopens (BELGIUM)

803 Hierarchical TiO2 Nanospheres for Water Purification
H. W. Bai (SINGAPORE)

804 Examination of the possible applications of pyrite ash in a modified Fenton process for reactive dye degradation
M. Becelic-Tomin, B. Dalmacija, L. Rajic, D. Tomasevic, D. Kerkez, M. Watson (SERBIA)

805 Fenton and photo Fenton process for treatment of landfill leachate generated in the city of Guanajuato, Mexico
A. Bernal-Martinez, C. J. Escudero-Santiago, G. Cuevas-Rodriguez (MEXICO)

806 Emerging Pollutants in the Paris suburbs drinking water plants
V. Branchereau, N. Fauchon, C. Feliers, A. Lang (FRANCE)

807 Bimetallic Fe-Co/GAC catalyzed peroxydisulfate with ultrasound irradiation for the degradation of Acid Orange 7 in water
C. Cai, L. Wang, H. Zhang (CHINA)

808 Endocrine disrupter removal by ozone/activated carbon coupling in continuous flow
O. Chedeville, Y. Barrot, F. Versaveau, A. Pineau, B. Cagnon (FRANCE)

809 Functionalisation of electrospun nanofibre membranes with titaniumdioxide nanoparticles
N. Daels, A. Goethals, K. de Clerck, S. W. H. van Hulle (BELGIUM)

811 Pretreatment of herbicide wastewater by the three-dimensional packed bed electrochemical reactor
Y. Feng, J. Liu, L. Zhu, H. Li (CHINA)

812 Degradation of organic pollutants with in situ generated hydrogen peroxide by Fenton process using bimetallic Fe-Pd nanoparticles
P. P. Ghute, S. S. Sable, S. Contreras, F. Medina (SPAIN)

813 DesinFixÂ® - Chlorine-free disinfection for water reuse applications
R. Gramstad (SWEDEN)

814 Options and limitations of hydrogen peroxide addition to enhance radical formation during ozonation of secondary effluents
U. Huebner, A. Bodnar, M. Jekel (GERMANY)

815 Degradation of an industrial azo dye by applying heterogeneous Fenton process using clay supported nanoscale zero valent iron
D. Kerkez, D. Tomasevic, M. Becelic-Tomin, B. Dalmacija, S. Roncevic, G. Kozma, Z. Konya (SERBIA)

816 Radioactive Iodine Removal through the Water Purification Process
S. Kimura (JAPAN)

817 Oxidized fulvic acids adsorption on activated carbon
I. Kozyatnyk, J. Swietlik, J. Nawrocki (SWEDEN)

818 Application of response surface methodology to the decolorization of Orange II in water by a novel electro/Î±-FeOOH/peroxydisulfate process
H. Lin, J. Wu, H. Zhang (CHINA)

819 Silver-modified 3D dendritic TiO2 microspheres for concurrent solar photocatalytic disinfection/decontamination and membrane filtration
L. Liu, R. P. Koh, D. D. Sun (SINGAPORE)

820 KN-B Removal from Water by Non-thermal Plasma
Y. Liu, S. Mei, G. Xue, S. Ognier (CHINA)

Poster Presentations Listing

THEME 8: ADVANCED OXIDATION - NEW TECHNOLOGIES AND APPLICATIONS

821 Energy efficient-Advanced oxidation processes for the treatment of Endosulfan pesticide containing industrial wastewater
R. Mudliar, R. Mudliar, D. Ramteke, S. Umare (INDIA)

822 Solid waste of water treatment plant -WTP used to treat and decompose amoxicillin by Fenton Oxidation Process
N. Ortiz, L. C. Freitas, F. Maichin (BRAZIL)

823 The use of steel converter slag - magnetite to decompose amoxicillin by Fenton Oxidation Process
N. Ortiz, L. C. Freitas, F. Maichin (BRAZIL)

824 Dielectric monitoring of viability and oxygen uptake rate measurements of activated sludge at different temperature
F. Pajoum Shariati, M. H. Sarrafzadeh, M. R. Mehrnia, M. Imani, A. Grasmick, M. Heran (REPUBLIC OF IRAN)

825 UV-based AOP treatment of high-salinity municipal wastewater reverse osmosis concentrate
F. Roddick, M. Umar, L. Fan (AUSTRALIA)

826 Toxic Phenol-Production Wastewater Treatment by Fenton and Biological Processes
K. Tudthiam, J. Anotai, C. Ruangchainikom (THAILAND)

827 Toxicity assessment of Advanced Oxidation Processes by means of respirometric measurements
P. van Aken, K. van Eyck, N. Lambert, J. Degreve, R. Dewil (BELGIUM)

IWA
the international water association

Project Innovation Awards

PROJECT SUBMISSIONS ARE NOW OPEN!

Make a splash.

The 2014 IWA Project Innovation Awards

Recognising excellence and innovation in water engineering projects throughout the world.

The IWA Project Innovation Awards (PIA) aims to highlight innovative water and wastewater engineering projects around the world, thus bringing recognition to these projects as models of engineering excellence and spreading the knowledge of water and wastewater science and management to the global water community.

Into its 5th edition, the IWA 2014 PIA is now open for project submissions for the regional competitions in Europe and West Asia, East Asia and the Asia-Pacific regions. All winning and honour awards projects from the regions, including North America* will be advanced to the global awards competition where they compete to become the Grand Awards Winners. The Global Project Innovation Awards Ceremony and Dinner will take place at the 9th IWA World Water Congress in Lisbon, Portugal in September 2014.

Entries are submitted for competition in one of the following six awards categories:

- Applied Research
- Design
- Operations/Management
- Planning
- Small Projects
- Marketing and Communications

The PIA is open to applicants who may be individuals, and companies, organizations, governmental bodies, or any combination of the above, whether or not the organization is a member of IWA.

*The North America Regional Awards is conducted through the American Academy of Environmental Engineers and Scientists (AAEES).

For more information, please visit **www.iwa-pia.org** or contact us at **pia@iwahq.org**

A subsidiary of the SUEZ ENVIRONNEMENT group, Degrémont has been the world water treatment specialist for more than 70 years, operating in more than 70 countries with over 5,000 employees.

Production of process or drinking water, desalination, wastewater treatment, wastewater recycling, sludge treatment... today our plants are in operation in more than 80 capitals thoughout the world.

Degrémont designs, builds, equips, operates and finances facilities that combine technical and economic performance with respect for natural and urban environments.

Degrémont applies its extensive expertise to supporting its municipal and industrial customers with the most advanced, appropriate, reliable and affordable solutions, tailored to local resources and conditions.

As well as securing a clutch of large-scale design-build projects, Degrémont placed a renewed focus on its equipment and services business and bolstering its industrial wastewater offering.

suez environnement
Degrémont

THE WATER TREATMENT SPECIALISTS