

1671<sup>st</sup> Conference

## INDUSTRIAL CHEMISTRY 2018



17<sup>th</sup> International Conference on

# Industrial Chemistry and Water Treatment

May 21-22, 2018 | New York, USA

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## Keynote Forum

Day 1

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## Masayoshi Tabata

Muroran Institute of Technology, Japan

### Emerging $\pi$ conjugated stretched and contacted helices of substituted polyacetylenes prepared with an organo-rhodium catalyst

The highly stereo-regular preparation of mono-substituted polyacetylenes (SPA)s was performed using an [Rh(norbornadiene)Cl] 2-triethylamine catalyst to give the  $\pi$ -conjugated helical polymers, because, the SPAs are expected as new advanced materials due to semi-conductivity, NLO properties, external stimulus responsibility, enantioselectivity, and oxygen permeability. These properties are strongly related to the geometrical structure, e.g., cis or trans forms and higher-order structure, e.g.,  $\pi$  stacking along with the helical main-chain in the solid phase. Therefore, we have investigated whether the geometrical and helical structures of the SPAs can be controlled through molecular design and/or external stimuli. The p-n-hexyloxyphenylacetylene (pPA) monomer was stereo-regularly polymerized using the Rh catalyst at 25°C. When ethanol and n-hexane were used as the polymerization solvents, a yellow P(Y), and its red P(R) were obtained, respectively. The diffuse reflective UV-vis spectra of these polymers showed  $\lambda_{\max}$  at 445 and 575nm, respectively. The WAXS patterns of P(Y) and P(R) exhibited hexagonal columnar structures which were attributed to the stretched and contracted helices, respectively. Additionally, P(Y) was irreversibly transformed into a reddish-black P(Y $\rightarrow$ B), whose columnar diameter was identical to that of P(R) when heated at 80°C for 1h. These findings suggest a thermally irreversible rearrangement from a thermally unstable P(Y) with a stretched helix to a stable P(Y $\rightarrow$ B) with a contracted helix. In the case of aliphatic polyacetylene ester, the mutual helical oscillation between the contacted and stretched helices was found in the solution.

### Biography

Masayoshi Tabata has completed his PhD from Hokkaido University, Japan and Post-doctoral Fellowship from United Kingdom and Sweden. After that, he became an Assistant Professor and Associated Professor at Hokkaido University, and Professor of Muroran Institute of Technology, Japan. Furthermore, he also became a Senior Research Director at National Institute of Advanced Industrial Science and Technology (AIST) at Tsukuba, Japan, and Guest Professor at Paris University in France.

tabata@mmm.muroran-it.ac.jp

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## Junwang Tang

University College London, UK

### Catalytic water purification driven by solar energy: Fundamental understanding and novel materials

Catalytic decontamination of water by solar energy has attracted substantial interest over the past decades. However, to develop an efficient photocatalyst for such environmental purification, in particular water treatment still remains a big challenge, involving Material Science, Chemistry, Engineering and Physics. In particular, there is not a cost-effective way to deal with large volume of water contaminated by small amount of organic substance or extreme large amount of contaminated water in suburban region (e.g. oil spill in Mexico Gulf, in China Bohai Sea). Inorganic photocatalysis using solar energy to mineralize organic contaminants in principal is the potentially best solution to these issues and works in the cost-effective way. Recently, we preliminarily illustrated the key factors dominating the efficiency of process driven by light irradiation. Following that, water treatment was carried out in my group which is a challenging topic due to its complexity. In this talk, the mechanism of the chemical process, involving charge transfer and reaction with oxygen, will be addressed and structured/junction material development will be presented, resulting into a few times higher activity for textile water treatment and simulated river water treatment compared with the benchmark photocatalyst P25. Furthermore, a new and facile method to synthesize these active photocatalysts will be discussed.

### Biography

Junwang Tang is the Director of UCL Materials Hub, Professor of Chemistry and Materials Engineering in the Department of Chemical Engineering, and a Fellow of the RSC. He has received his PhD in Physical Chemistry in 2001. After taking a JSPS Fellowship in Japan he became Senior Researcher in Imperial College London. Later, he has joined the Department of Chemical Engineering at University College London to take a Permanent Faculty position. He currently leads a research team including postdoctoral researchers, academic visitors and research students with financial support from UK EPSRC, Leverhulme, Royal Society, Royal Academy of Engineering, Newton Fund, EU PF7, Qatar and so on.

[junwang.tang@ucl.ac.uk](mailto:junwang.tang@ucl.ac.uk)

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## Jun-ichi Kadokawa

Kagoshima University, Japan

### Enzyme as useful catalyst for precision synthesis of functional polysaccharide materials

Natural polysaccharides such as cellulose, starch, and chitin are widely distributed in nature and thus considered as the very important biomass resources. They can also be expected as functional materials, which are applicable in biomedical, tissue engineering, and environmentally benign fields. Therefore, the efficient methods for synthesis of functional polysaccharides have attracted much attention to provide new materials employed in such application fields. Enzymatic approaches have increasingly been important to precisely synthesize functional polysaccharide materials. Phosphorylase is one of the enzymes, which have been practically employed as catalysts for the synthesis of polysaccharides with well-defined structures. This enzyme catalyzes enzymatic polymerization of  $\alpha$ -D-glucose 1-phosphate (Glc-1-P) as a monomer initiated from the nonreducing end of maltooligosaccharide primer to produce  $\alpha$ (1 $\gamma$ 4)-glucan, that is amylose (Figure 1). The author has reported precision synthesis of functional polysaccharide materials by phosphorylase-catalyzed enzymatic reactions. By means of the property of spontaneously double helix formation from amyloses, for example, it was reported that the phosphorylase-catalyzed enzymatic polymerization using the immobilized primers forms network structures composed of the double helix cross-linking points. In most cases, accordingly, the enzymatic polymerization solutions have turned into hydrogels with high water contents. As an example, the phosphorylase-catalyzed enzymatic polymerization using the immobilized primers on chitin nanofibers was investigated to produce amylose-grafted chitin nanofiber hydrogels. On the other hand, the author has also reported that by means of the phosphorylase-catalyzed enzymatic polymerization using analog substrates as monomers, well-defined polysaccharides with functional groups are efficiently obtained. For example, phosphorylase isolated from thermophilic bacteria, *Aquifex aerolicus* VF5, catalyzed the enzymatic polymerization of  $\alpha$ -D-glucosamine 1-phosphate (GlcN-1-P) as a monomer from maltotriose primer. The enzymatic reaction was accelerated in ammonia buffer containing  $Mg^{2+}$  ion, owing to the precipitation of inorganic phosphate, giving the high molecular weight aminopolysaccharide, which corresponded to chitosan stereoisomer.

### Biography

Jun-ichi Kadokawa has received his PhD in 1992. He then joined Yamagata University as a Research Associate. From 1996 to 1997, he worked as a Visiting Scientist at the Max-Planck-Institute for Polymer Research in Germany. In 1999, he became an Associate Professor at Yamagata University and moved to Tohoku University in 2002. He was appointed as a Professor of Kagoshima University in 2004. His research interests focus on polysaccharide materials. He has received the Award for Encouragement of Research in Polymer Science (1997) and the Cellulose Society of Japan Award (2009). He has published more than 200 papers in academic journals.

[kadokawa@eng.kagoshima-u.ac.jp](mailto:kadokawa@eng.kagoshima-u.ac.jp)

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## Toshiki Aoki

Niigata University, Japan

### Application of the products by highly selective photocyclicaromatization of cis-cisoidal poly (substituted phenylacetylene)

We have already reported a petit top-down preparation method for self-supporting supramolecular polymeric membranes by a novel highly selective photocyclicaromatization (SCAT), although supramolecular polymeric materials are usually prepared by bottom-up methods. The SCAT reaction converted  $\pi$ -conjugated polymers from phenylacetylene having two hydroxyl groups to exclusively yield a 1,3,5-trisubstituted benzene derivative whose structures were confirmed by H-NMR, GPC, and TOF-MS. The SCAT reaction had many unique characteristics, such as unusual selectivity, as follows. 1) a quantitative reaction: it gave only the corresponding cyclic trimer, i.e., a 1,3,5-trisubstituted benzene derivative. 2) an intramolecular reaction, 3) a stereospecific and template reaction, 4) a photoreaction, 5) a solid-state reaction. In addition, 6) the resulting cyclic trimers had the ability to form a self-supporting membrane, in spite of their low molecular weights. Since, SCAT has such high selectivity and is useful for the preparation of a self-supporting supramolecular polymer membrane, many kinds of applications can be expected. In this lecture, some applications of the unique reaction products will be presented based on the advantages above mentioned. For example, 1) analysis of the microstructures of the starting polymers, 2) examination of gas permeation through the supramolecular polymers, 3) synthesis of new types of multistranded polymers, and 4) exfoliation of two-dimensional network polymers.

### Biography

Toshiki Aoki has received his Bachelor, Master, and Doctorate Degree (1987) in the Department of Applied Chemistry at Nagoya University, Japan. He has joined Fluorine Chemistry Division at Government Industrial Research Institute, Nagoya in 1987–1989. He has moved to Department of Applied Chemistry at Niigata University in 1989 and became a Full Professor (2000). He worked as a Visiting Scientist at University of Southern California in 1998–1999. His research interest covers synthesis of functional polymers, including synthesis of new chiral polymers for permselective membranes. His recent interest is in synthesis and application of two-dimensional polymers using HSSP and SCAT reactions.

[prof.aoki@gmail.com](mailto:prof.aoki@gmail.com)

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## Ram K Gupta

Pittsburg State University, USA

### Improved 2-dimensional materials for hydrogen evolution reactions

Hydrogen production from water electrolysis is one of the greenest ways to generate fuel for commercial applications. Commercial application of water electrolysis requires low cost, high performance and stable electrocatalysts which can operate at low overpotential. The current state-of-the-art noble metal-based electrocatalysts such as platinum are the most efficient electrocatalysts for water electrolysis; however, their high cost and limited availability have curtailed their extensive use as electrocatalysts. In this research, we have synthesized a catalyst using a cost-effective method for water electrolysis. The 2-dimensional catalyst was synthesized using earth abounding elements and its electrocatalytic activities were improved by one step facile chemical treatment. Core-shell nanostructured 2-dimensional molybdenum sulfide was synthesized using chemical vapor deposition method and was treated with hydrazine to improve its catalytic activities. Hydrazine treated catalyst showed significant improvement in the electrocatalytic performance. They showed about 100mV improvement in overpotential after exposure to dilute hydrazine at room temperature with a significant change in Tafel slope. Mechanism of such improvement in the catalytic properties will be discussed in detail. Our studies suggest that simple chemical treatment process can be adopted to improve catalytic properties of 2-dimensional material which was derived from earth abundant elements for industrial production of hydrogen as a fuel.

### Biography

Ram K Gupta is an Assistant Professor of Chemistry at Pittsburg State University. His research focuses on green energy production and storage using conducting polymers, composites, nanomaterials and utilizing bio-based polymers for commercial applications. He has published over 160 peer-reviewed journal articles, made over 150 national/international/regional presentations, chaired many sessions at national/international meetings, and received over 1 million dollars for research and educational activities from external agencies NSF, DoE. He is serving as Associate Editor and Editorial Board Member for various journals. He is also serving as Keynote Speaker and Organizing Committee Member for Industrial Chemistry international conference.

[ramguptamsu@gmail.com](mailto:ramguptamsu@gmail.com)

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## Keynote Forum

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## Tamaki Nakano

Hokkaido University, Japan

### Chirality induction to polymers and oligomers using circularly polarized light through enantiomer-selective photo excitation

Interactions between substances and light play important roles in life. One of the most important aspects is photosynthesis by plants and other organisms. In photosynthesis, sugars and molecular oxygen are produced from carbon dioxide and water where photon energy drives the reaction. Moreover, in artificial chemical synthesis, light promotes various reactions that are not driven by thermal energy. Further, in reactions where chiral compounds are produced, non-racemic products can be obtained using circularly polarized light (CPL). We recently reported that a preferred-handed helical conformation is induced for a linear polyfluorene derivative (poly (9,9-dioctylfluorene-2,7-diyl [PDOF])) in the solid state when the polymer is irradiated with CPL. The mechanism of this chirality induction involves a twisted-coplanar transition (TCT) of an aromatic-aromatic junction in the polymer where one of the enantiomeric, right- and left-handed twists is preferentially excited into the coplanar conformation. TCT through photo excitation was first predicted for biphenyl through theoretical calculations. In the CPL-driven helix formation of the linear polyfluorene derivative, strong inter-chain interactions were important in effectively induce chirality, which in turn implicates that polymers with weak inter-chain interactions cannot be subjected to the CPL method. This point of the CPL method was overcome using aid molecules which reinforce or simulate inter-chain interaction; a star-shaped fluorene oligomer having only weak inter-chain interactions was successfully made optically active. In addition, photo-transformation of 1,10-bi(2-naphthol) (BINOL) was studied.

### Biography

Tamaki Nakano received his BSc (1986), MSc (1988), and PhD (1991) degrees from Osaka University, Japan. He has joined Nagoya University as an Assistant Professor (Prof. Yoshio Okamoto's group) in 1990 and was promoted as Associate Professor in 1998. During his appointment at Nagoya University, he also served as a Visiting Scientist at Cornell University (host: Prof. Dotsevi Y Sogah, 1993–1994). In 1999, he moved to Nara Institute of Science and Technology (NAIST) as an Associate Professor. He was appointed as a Professor of Hokkaido University in 2006 and is currently supervising his research group in Institute for Catalysis.

[tamaki.nakano@cat.hokudai.ac.jp](mailto:tamaki.nakano@cat.hokudai.ac.jp)

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## Manuel Alvarez Cuenca

Ryerson University, Canada

### The multistage vertical bioreactor in water engineering: Ammonia and phosphorous compounds removal from contaminated water

The availability of water quality and quantity is facing an unprecedented crisis created by explosive demographic growth and overuse hence urban and industrial scarcity, limited construction surface and increasing chemical complexity of contaminants, like nutrients, microplastics, endocrine disruptors, etc. Contaminated water is defined here as water not suited for direct human consumption or industrial utilization whose composition has deleterious effects on either human health or the environment. The recovery of water for human utilization presents an unprecedented challenge. That recovery demands effective reactors, of reduced power consumption, demanding little construction surface for retrofitting and refurbishing. Historical records show that contaminated water has been treated to achieve potability for thousands of years. The treatment was only physical (sand filtration) but in more recent times contaminated water has been treated chemically and biologically, or the physical treatment has become more complex. Planar bioreactors (often called aeration tanks) of circular or rectangular cross section have been the first choice for water engineers. Furthermore, in the last few decades, the kinetics of the processes, the control and instrumentation, and the reactor design of the biochemical reactors involved have become more precise and sophisticated. The purpose of this presentation is to describe the STAR process including the application of the Multistage Vertical Bioreactor (USA Patent 8,585,900 B2) to the elimination of nutrients in contaminated water. This bioreactor developed in the Department of Chemical Engineering of Ryerson University (Canada), offers powerful features associated to its performance removal, construction materials, reduced planar construction space, geometry and modular configuration. The simultaneous removal of both ammonia and total phosphorous exceeds 93% for each contaminant. Two abundant microbial groups (unidentified species) and *Zoogloea* are responsible for the simultaneous removal of ammonia and total phosphorous in the process.

#### Biography

Alvarez Cuenca is a Professor of Chemical Engineering and Director of the Water Technologies Laboratory at Ryerson University (Toronto, Canada). He holds a BEng (Chemical Engineering) from the Universidad Politecnica de Madrid, and an MSc and a PhD in Physics and Chemical Engineering respectively from the University of Western Ontario (Canada). He adds to his curriculum over 15 years of industrial experience with multinational corporations in the areas of fluidized bed reactors, bioreactor design, water treatment and clean power generation. In 2002, he founded Ecotechnos Inc., a company devoted to the design and construction of advanced bioreactors for the treatment of industrial wastewater including nitrogen and phosphorous removal. He is an active consultant for both, government and the private sectors in Canada, Spain and Ibero-America in the areas of water treatment, and energy. His academic record spans over three decades with universities in Europe, Canada, and South America, including Ryerson University, U. of Western Ontario, U. of Waterloo, U. of Guelph, U. of Windsor, U. Politécnica de Madrid (Spain), Universidad Nacional de Colombia (Colombia), U. de Cartagena de Indias (Colombia), Corporacion Universitaria de la Costa (Colombia).

ecotechnos@rogers.com  
mcuenca@ryerson.ca

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## Hussam Jouhara

Brunel University London, UK

### Pyrolysis of domestic based feedstock up to 300°C and applications of its products

The Global discarding of resources is increasing at an alarming rate. Current technology is available to treat a variety of these resources. However, the majority of waste conversion methods is economically unviable on large scale and has many complications. Pyrolysis is commonly operated at high temperature in order to thermally degrade feedstock into syngas, bio-oil and biochar. High temperature pyrolysis has a high cost and danger aspects to operate at a domestic level. Therefore, low temperature pyrolysis offers a thermal degradation mechanism, whereby it costs less and produces high value products. The chemical characteristics of the bio-oil formed from low temperature pyrolysis are similar to that of diesel and gasoline. Chemical reformation may be needed to ensure the bio-oil properties are appropriate for the intended use. The syngas produced consists of light hydrocarbon chains as well as CO<sub>2</sub> and CO. The biochar formed has desirable characteristics for it to be used as a water filter. These characteristics include a wide pore size distribution, high adsorption capacity and no toxic compounds, such as polycyclic aromatic hydrocarbons PAHs, being formed. The entire different product phases formed contains high heating values, enabling them to be used as fuel resources. These products can also be used as chemical feedstock for various chemical processes. Low temperature pyrolysis offers an alternative method to dispose of discarded household materials and recover valuable chemicals. The advantages of such process are low cost and the least environmental impact and a wide range of applications of its products.

### Biography

Hussam Jouhara is an Associate Professor in Brunel University London since obtaining his PhD from Manchester University in 2004. He has unique expertise in working on applied heat exchangers and energy-related research activities with direct support from research councils and various UK and international industrial partners. He has extensive expertise in designing and manufacturing various types of heat exchangers, including heat pipes and heat pipe-based heat exchangers for low, medium and high temperature applications. His work in the field of heat pipe based heat exchangers resulted in novel designs for recuperators, steam generators & condensers and flat heat pipes. These have been implemented across various industries including, but not limited to: food, electronics thermal management and low to high industrial waste heat recovery and Energy from Waste.

[hussam.jouhara@brunel.ac.uk](mailto:hussam.jouhara@brunel.ac.uk)

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## Geraldo Balieiro Neto

Sao Paulo State Government of Agriculture and Food Supply, Brazil

### Effects of magnetic treated water on rats and cows hemogasometry

The goal of this study was to evaluate the effect of magnetic water on blood gas level of rats and cows. Twenty six jersey cows and forty-eight wistar rats were divided into two groups: control (cows=13, rats=24), drinking regular water and the group test, drinking magnetic water-treated (cows=13, rats=24). A completely randomized design was used. Blood samples were collected from caudal auricular artery in cows and from femoral artery in rats. The water treatment was performed using a commercial magnetic conditioner (Sylocimol) designed to generate a strong magnetic monopole field of 3,860 Gauss. These devices were inserted into the water troughs. No significant difference was found in the water intake between the groups. The  $SO_2$  (91.75% vs 94.60%) was higher and levels of  $CHCO_3$  (28.66 vs 25.04mmHg) and  $pCO_2$  (53.85 vs 46.40mmHg) showed unusual reductions with the same pH and anion gap in the arterial blood of the rats drinking the magnetic water-treated and there was no difference in blood pH (7.32 vs 7.31), because of the systemic acid-base balance. On the other hand no significant difference was found on  $CHCO_3$  (26.17 vs 25.87mmHg) and  $SO_2$  (98.4% vs 98.3%) however higher pH (7.44 vs 7.40,  $p<0.05$ ) and lower  $pCO_2$  (37.97 vs 42.47mmHg,  $p<0.05$ ) were found in arterial blood of cows drinking magnetic-treated water compared to control group. These effects were attributed due reduced metabolism in kidney to bicarbonate buffer production. The consumption of water treated by magnetic field provided an effective way to decreased metabolic acidosis.

### Biography

Geraldo Balieiro Neto has completed his PhD from São Paulo State University and Post-doctoral studies from University of Evora. He is a Scientific Researcher in full dedication to research (40h) and a Research Director from São Paulo State Government, in Department of Agriculture and Food Supply, São Paulo Agency for Agribusiness Technology (APTA), since Jun 13, 2005. He has published more than 27 papers in reputed journals and has been serving as an Editorial Board Member of reputed.

geraldobalheiro@apta.sp.gov.br

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