



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

# GREEN CHEMISTRY & TECHNOLOGY

June 18-20, 2018 | Dublin, Ireland

# POSTERS

## HIGH SPEED ZINC-PHOSPHATE COATING METHOD WITH ACIDIC ELECTROLYTES ON METAL SURFACE

### Erkan Karayigit

Southern Steel Mesh and Iron Mam. San Tic. Inc., Turkey

The surface cleaning and preparation processes which are developed to meet the high resistance, long life and surface quality expected from the coating/paint application more effectively, are called phosphating. It is known that the protection of metallic surfaces with phosphate coating, especially the protection of iron and steel surfaces. This process is a traditional method and limits the speed and capacity of wire production due to the long process times in chemical baths, slow rate of deposition on the surface, high phosphate consumption, the difficulty of bath control. Phosphate performance also decreases with deterioration of bath quality. The purpose of this work is to provide a very successful phosphate layer on steel wires which are rapidly phosphated by acidic electrodes. In such a case, the performance of the bath can be enhanced by the ability to rapidly form the phosphate film layer. This method provides an innovative and technological superiority in the industry, while playing an active role in solving the problems specified, both in terms of standardizing the coating quality.

## BIOGRAPHY

Erkan Karayigit has completed his Bachelor's degree from Erciyes University and Post-graduate studies from Baskent University. He is the Director of Research and Development Department of Guney Celik Company.

[erkan@guneycelik.com.tr](mailto:erkan@guneycelik.com.tr)



## HEAT TRANSFER MODELING TO IMPROVE THE LIFESPAN OF LED BY Al/Cu COMPOSITE HEAT SPREADER

**Dong-Hee Lee, Dae-Young Kim and Jong-Hyeon Lee**

National University, Republic of Korea

LEDs are known as more environmental than incandescent bulbs and fluorescent lamps. In addition, LEDs are smaller, durable, longer in life, brighter in brightness and much lower in power consumption compared to bulbs and fluorescent lamps. The LED structure is very weak against heat. Therefore, heat dissipation performance is one of the most important consideration of LED. The heat sink is mostly made of Al series in the market due to light weight and excellent thermal conductivity. However, as the output of the LED increases, existing heat-dissipating materials are facing the limit. Hence, the focus of this study was on improving the efficiency of LED by changing the thermal conductivity characteristics of the heat sinks using Al/Cu composite instead of Al heat-dissipating material. The cooling efficiency of the LED is depended on what the TIM material is used. So, we calculated the cooling efficiency of LED according to this TIM material through computer simulation and compared the LED lifetimes of Cu, Al and Al/Cu composite heat-dissipating materials. Ansys-CFX was used to calculate the cooling efficiency of the LED according to TIM thermal resistance, the output of the LED and the ratio of Al/Cu composite.

## BIOGRAPHY

Dong-Hee Lee has completed his graduation in Advanced Material Engineering from Hanbat University (Republic of Korea). After graduation, he has started to study Material Science Engineering in the Graduate School of Chungnam National University. Especially, computational modeling is primary study field. Heat transfer modeling has been performed to enhance cooling efficiency of LED.

[ldh36427@cnu.ac.kr](mailto:ldh36427@cnu.ac.kr)



Note:

## GRAPE POMACE-DERIVED PRODUCTS: A COMPARATIVE STUDY REGARDING NUTRITIONAL COMPOSITION

**Anabela S G Costa, Rita C Alves, Liliana Espírito Santo, M  
Antónia Nunes and M Beatriz P P Oliveira**

University of Porto, Portugal

**W**ine-making industry produce millions of tons of residues (grape pomace), which need proper management, both ecological and economic levels to answer to sustainable issues. Grape pomace is mainly composed by grape skins and seeds and can be used for tartaric acid extraction or ethanol production. It can also be used as soil fertilizer, but its high levels of phenolics can represent an issue since they inhibit seed germination. Grape seeds can be used to obtain grape seed oil, which is known for its nutritional value (72% of linoleic acid and a very high smoking point, being adequate for frying) and moisturizing properties (with interest for cosmetics). After oil production, a residue is obtained-grape seed flour-which is a good source of polyphenols, including proanthocyanidins, and dietary fiber. Cellulose, hemicelluloses, and water extractable proteins essentially constitute grape skins that remain after seeds removal. In order to characterize these grape pomace-derived products, evaluate their potential for food, and feed applications, their nutritional composition was assessed according to official methods. The results show significant differences ( $p < 0.05$ ) between samples, with the grape seed flour presenting the highest content of total dietary fiber (82.4%) and the lowest amounts of available carbohydrates (2.7%) and total fat (0.5%). In turn, grape skins contained significantly higher levels ( $p < 0.05$ ) of total minerals (8.7%) and available carbohydrates (11.8%), while grape seeds were the richest in total fat (9.5%). As expected, the mixture of grape skins and seed flour presented an intermediate profile compared to its original matrices, showing a high content of dietary fiber (70.8%), protein (12.5%) and ash (6.4%). In general, all these grape pomace-derived products can be seen as interesting sources of protein and dietary fiber.

## BIOGRAPHY

Anabela S G Costa is a Postgraduate Laboratory Technical (MSc) at the Faculty of Pharmacy of the University of Porto, Portugal. Since 2007, she is a researcher of REQUIMTE (*Rede de Química e Tecnologia*), the largest network in Chemistry and Chemical Engineering established in Portugal, which is focused on the development of Sustainable Chemistry. Her research activities have been developed at the Department of Chemical Sciences of the Faculty of Pharmacy of the University of Porto in the area of Nutrition and Food Chemistry. She has 24 publications, cited over 200 times. Formerly, she completed her degree in Chemical Engineering at School of Engineering of the Polytechnic of Porto in 2010, and a Master's degree in Consumer Sciences and Nutrition from Faculty of Sciences of the University of Porto in 2012.

[acosta@ff.up.pt](mailto:acosta@ff.up.pt)



Note:

## RECOVERY EFFICIENCY OF ZR ACCORDING TO PARTICLE SIZE OF BAF2 FROM WASTE PICKLING ACID SOLUTION OF ZR CLAD TUBE

**Wan-Bae Kim, Seong-Hun Lee, Young-Jun Lee and  
Jong-Hyeon Lee**

Chungnam National University, Republic of Korea

In order to manufacture Zr cladding, several pickling and intermediate heat treatment processes are required. During these processes, tube surface contaminated by lubricant as well as oxide layers is cleaned by a mixed hydrofluoric and nitric acids. As the number of pickling process increases, the pickling efficiency decreases since Zr solubility in the pickling acid decreases. As a result, the pickling solution requires frequent replacement. The spent pickling acid is conventionally neutralized by using caustic soda (NaOH), followed by an evaporation concentration and finally disposed. Hence, the conventional waste treatment process has inherent problem that the rare metal Zr dissolved in the spent pickling solution can't be recycled. This study investigates an environmentally benign recycling method for Zr as well as the spent pickling acid that involves adding BaF<sub>2</sub> to spent pickling acids to produce Ba<sub>2</sub>ZrF<sub>8</sub> through chemical precipitation without neutralization. In particular, a particle size analyzer, FE-SEM, EDX, ICP, and XRD analysis was utilized to evaluate the Zr recovery efficiency according to the particle size of BaF<sub>2</sub> which is used as a precipitant and the characteristics of the precipitates. As a result of experimentation, the Zr concentration in the recovered pickling acid was found to be 127 ppm when the particle size of the BaF<sub>2</sub> used as a precipitant is 500 nm or lower, and the concentration of residual Ba in the pickling solution was less than 100 ppm.

## BIOGRAPHY

Wan-Bae Kim has studied at Chungnam University, Republic of Korea. His major is Electroreduction and Electrorefining. He has studied at the Department of Materials Science and Engineering and Nanomaterial process laboratory of prof. Jong-Hyeon Lee.

[dhksq07@cnu.ac.kr](mailto:dhksq07@cnu.ac.kr)



## **ELECTRO DECONTAMINATION BEHAVIOR OF THE SIMULATED RADIOACTIVE NI-CO ALLOY WASTE USING ELECTROREFINING IN LiCl-KCl 5-WT.% NiCl<sub>2</sub>**

**Woo-Seok Choi**

Chungnam National University, Republic of Korea

As the number of end-of-life reactors increases in the world, the demand for decontamination technology is increasing. In Republic of Korea, there is an urgent need to secure nuclear power plant decommissioning technology as eight nuclear power plants will reach the end of their lifespans by 2030, the first being the Kori unit 1, which was the 161<sup>st</sup> nuclear power plant to be permanently shut down in the world on June, 2017. Presently, Republic of Korea is focusing on developing and supporting technology required for nuclear decommissioning, and 27 core technologies for decommissioning have been secured. However, there is insufficient development of decontamination technology for the reduction and recycling of large amounts of radioactive metal wastes, which totaled up to 26,255 m<sup>3</sup> in the case of the Kori unit 1. This study utilized an Inconel-1~10 wt. % Co alloy to simulate radioactive metal waste to investigate the decontamination potential of LiCl-KCl-5 wt.% NiCl<sub>2</sub> molten salt electrolytes. Electrochemical analysis was performed by conducting cyclic voltammetry to confirm the redox behavior of Ni ions in LiCl-KCl-5 wt.% NiCl<sub>2</sub> electrolytes. Decontamination experiments were performed by conducting cyclic voltammetry to analyze the oxidation behavior of Inconel-1~10 wt.% Co alloy metals (anode) and the reduction behavior of STS316L (40 mm x 80 mm x 0.5t) electrodes (cathode), in addition to the properties of the electrolyte. By conducting experiments, the reduction potential of Ni at a potential of -0.17 V (vs. W reference electrode) was confirmed, and the Co decontamination factor (DF) of the reduction product was found to have a value of 2,480 through ICP-MS analysis. The reduced products produced from the first electrolytic refining stage is expected to satisfy the allowable concentration for self-disposal ( $3.04 \times 10^{-4}$  Bg/g) after the second electrolytic refining stage.

## **BIOGRAPHY**

Woo-Seok Choi has studied at Chungnam University, Republic of Korea. His major is electroreduction and electrorefining. He has studied at the department of materials science and engineering and nanomaterial process laboratory of Prof. Jong-Hyeon Lee.

[wschoi@cnu.ac.kr](mailto:wschoi@cnu.ac.kr)



Note:

## EFFICIENT PHOTOELECTROCHEMICAL WATER OXIDATION BY COBALT PHOSPHATE MODIFIED COMPOSITE

**Kyo-Seon Kim, Tangnuer Sadike and Jin-Rui Ding**

Kangwon National University, South Korea

Photoelectrochemical (PEC) water splitting is considered as one of the most promising approaches to convert solar energy into hydrogen energy. It involves hydrogen evolution reaction and oxygen evolution reaction (OER) and OER is a kinetically more difficult reaction.  $\text{WO}_3$  nanowire has attracted much attention due to its favorable valence band position for water oxidation, better electron transport property and chemical stability. Moreover,  $\text{BiVO}_4$  is a promising photoanode with its optical band gap for visible light absorption and can form the heterojunction structure with  $\text{WO}_3$  to complement each other's advantages. Through this configuration, charge separation efficiency is highly enhanced with reduced recombination rate. Besides, it is also important to improve charge reaction kinetics at the electrode and electrolyte interface by applying oxygen evolution catalysts (OEC). A simple and effective earth-abundant catalyst known as cobalt phosphate (Co-Pi) was discovered as oxygen evolution catalysts by Nocera and coworkers and was applied to improve the photoanode performances. We studied the effect of Co-Pi on  $\text{WO}_3/\text{BiVO}_4$  composite photoanode. The nanostructure  $\text{WO}_3$  was prepared by flame vapor deposition (FVD) and was coated by  $\text{BiVO}_4$  using spin coating method. The Co-Pi OEC is deposited onto the  $\text{WO}_3$  photoanode and  $\text{WO}_3/\text{BiVO}_4$  (core-shell) heterojunction structure, respectively, by photo-assisted electrodeposition method. When Co-Pi was deposited on  $\text{WO}_3/\text{BiVO}_4$ , the onset potential was shifted negatively accompanied with increased photocurrent, while Co-Pi on  $\text{WO}_3$  didn't show such significant improvement.

## BIOGRAPHY

Kyo-Seon Kim is currently a Professor of Chemical Engineering at Kangwon National University, Chuncheon, South Korea, where he has been working from 1989. He received his BS, MS and PhD degrees all in Chemical Engineering from Seoul National University, KAIST and University of Cincinnati, OH, USA in 1979, 1981 and 1989, respectively. His research interests are mainly focused on preparation and modification of nanoparticles for high-functional performances. The main applications of nanoparticles in his researches are in the fields of air pollution control, energy harvesting and development of medical devices.

[kkyoseon@kangwon.ac.kr](mailto:kkyoseon@kangwon.ac.kr)





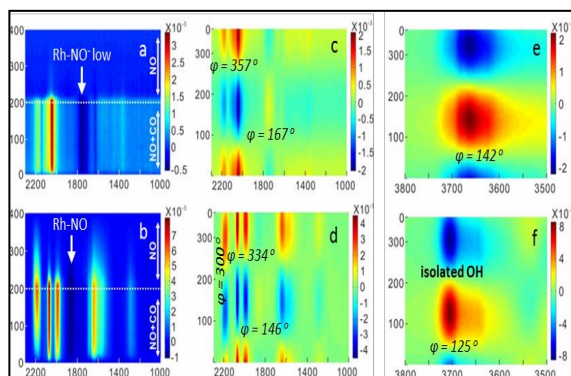
## IN SITU MODULATION EXCITATION IR SPECTROSCOPY IN ENVIRONMENTAL CATALYSIS: NOX REMOVAL BY AU CATALYSIS

Xianwei Wang<sup>1</sup> and Nobutaka Maeda<sup>1,2</sup>

<sup>1</sup>Dalian University of technology, China

<sup>2</sup>Dalian Institute of Chemical Physics, China

One of the greatest challenges for in situ characterization by Fourier transform infrared (FTIR) spectroscopy for environmental catalysis is to discriminate active species from spectator species dominating the surface under steady-state reaction conditions. Hence, the selective extraction of active species would be especially valuable for analyses of heterogeneous catalysts. A transient spectroscopic technique, modulation excitation spectroscopy (MES), was reported for the selective discrimination by operating under an unsteady-state condition with a periodic external perturbation, e.g. concentration. The phase sensitive detection (PSD) was additionally applied to transform time-domain spectra to phase-domain spectra<sup>1</sup>. Recently, we have applied this state-of-the-art spectroscopic technique for NO reduction by CO over AuRh/TiO<sub>2</sub> nanowire (NW) catalysts. Figure 1 shows in situ MES-IR spectra under NO-modulated NO-CO reaction on AuRh/TiO<sub>2</sub> and AuRh/TiO<sub>2</sub>-NW. MES combined with PSD increased the signal-to-noise (S/N) ratio, and time-resolution even in the low absorbance range. Extraction of kinetic information of adsorbed CO and NO on Au and Rh surfaces, isocyanate species (-NCO), hydrogen-bonded OH and isolated OH on support materials were clearly displayed in the phase-domain spectra. Negative NO bands (highlighted in blue) in Figures 1a and 1b demonstrates the NO molecules adsorb differently on TiO<sub>2</sub> and TiO<sub>2</sub>-NW. The phase-domain spectra (Figures 1c, 1d, 1e and 1f) display a dynamic perspective on the catalytic cycles: -NCO formation on isolated OH groups and its reaction with NO to produce final products, i.e., N<sub>2</sub> and CO<sub>2</sub>. Figure 1: (a, b) time-domain; (c, d, e, f) phase-domain spectra during periodic change in the gas-phase compositions between NO + CO and NO over (a, c, e) AuRh/TiO<sub>2</sub> and (b, d, f) AuRh/TiO<sub>2</sub>-NW catalysts.



## BIOGRAPHY

Xianwei Wang is the PhD candidate in School of Environmental Science & Technology, Dalian University of Technology, China. He did his research on Catalytic reduction of nitric oxide by carbon monoxide. Synthesis and modification of Au-based catalysts Application of in situ modulation excitation infrared spectroscopy for monitoring catalytic solid-gas and solid-liquid interfaces and also the In situ ATR-IR Spectroscopic study of catalysts surfaces under high pressure and temperature

[wxwei@mail.dlut.edu.cn](mailto:wxwei@mail.dlut.edu.cn)



## SUSTAINABLE POLY(HYDROXYURETHANE) S THERMOSET ADHESIVES FOR AFFIXING METALS

**Satyannarayana Panchireddy, Bruno Grignard, Jean-Michel Thomassin, Christine Jerome and Christophe Detrembleur**

University of Liège, Belgium

In the last five years, isocyanates-free polyhydroxyurethanes (PHUs), synthesized by step-growth polymerization between bis-cyclic carbonates and di- or poly-amines, have emerged as a novel class of polyurethanes (PUs). These PHUs find promising applications in flooring, paints, as thermoset materials or (thermal insulation) foams. PHUs can be also exploited advantageously for designing the next generation of high performance polyurethane adhesives. Thanks to the presence of pendant hydroxyl groups favoring the polymer/substrate interactions, the adhesion performances of PHUs may equal or even surpass the ones of conventional PUs. In this contribution, we focused on the design of novel reinforced bio- and CO<sub>2</sub>-based PHU thermosets adhesives with high shear adhesion strength for metal substrates (aluminum and stainless steel). The research included: The synthesis of a library of bi- or multifunctional 5-membered cyclic carbonates by coupling CO<sub>2</sub> with (bio-based) epoxidized precursors using a novel home-made binary organocatalyst highly performant under very mild experimental conditions. The development of solvent-free reinforced PHU thermoset adhesives from various cyclic carbonate/amine/functional fillers formulations. For all formulations, curing kinetics was monitored by rheology to determine the gelation time and the thermo-mechanical and physico-chemical properties of PHUs were evaluated on free-standing films. The evaluation of the adhesives performances for metal sticking: The adhesion of (reinforced) PHUs onto Al-2024-T3 or stainless steel substrates was evaluated by standard cross-cut adhesion (5B) and MEK double rubber (>300) tests and shear adhesion strength (>16 MPa).

## BIOGRAPHY

Satyannarayana Panchireddy received his MSc degree from University of Hyderabad, India, in 2012. He works as a Research Assistant (DR-DO-Junior Research Fellow) on Synthesis of Norbornene Derived Polymers at Indian Institute of Science Education and Research-Kolkata (IISER-K), India, in 2012-13. He moved to KU Leuven, Belgium, in 2014-15, to work as Research Associate on Polyelectrolyte Thin Film Membranes. He is currently a PhD Researcher under supervision of Professor Christine Jerome, and Dr. Christophe Detrembleur at Laboratory of Center for Education and Research on Macromolecules (CERM), University of Liège, Belgium. His current research focused on the synthesis and development of novel sustainable non-isocyanate polyurethanes for innovative applications as coatings and adhesives for automotive, aerospace, electronics, footwear, pharmaceuticals etc.

[satyasjgc31@gmail.com](mailto:satyasjgc31@gmail.com)



Note:

## THE USE OF PEAT-BASED BIOCHAR AS AN ADDITIVE TO MANURE MANAGEMENT SYSTEMS TO REDUCE GREENHOUSE GAS EMISSIONS

**Josephine Getz**

Dublin Institute of Technology, Ireland

Climate change is a naturally occurring phenomenon which is affected by anthropogenic greenhouse gas emissions. The agricultural sector accounts for 10-12% of global emissions. Out of which manure management causes almost 10% of global agricultural greenhouse gas emissions, making it an important target area for mitigation strategies. The Irish agriculture sector accounts for nearly 33% of the total national greenhouse gas emissions in Ireland and is obliged by national and EU-Kyoto Protocol regulations to lower these emissions. The use of biochar has been recognized in the abatement of greenhouse gas effluxes in the manure management cycle. Biochar is the product of the thermochemical conversion of biomass in a process called pyrolysis. Although the production from many common sources is well understood, there remains considerable uncertainty over the efficacy of biochar production from peat. At the moment, peatlands (blanket and raised bogs) cover approximately 17% of Ireland, suggesting that a small portion of the overall peat land area could provide a significant feedstock bio-resource for biochar production. In this study the profile and character of peat-based biochar relative to other feedstock sources will be explored, its potential to mediate reductions in greenhouse gas emissions for manure management systems will be evaluated. Initial analysis will focus on peat samples selected from the upper layers of a drained raised bog and the extracted fibre content of this peat as a biochar feedstock.

## BIOGRAPHY

Josephine Getz is recently pursuing PhD at Dublin Institute of Technology, after completing master's degree from Humboldt University of Berlin in 2016. Josephine also worked at The University of Edinburgh as a pyrolysis research assistant.

[josephine.getz@mydit.ie](mailto:josephine.getz@mydit.ie)





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

# GREEN CHEMISTRY & TECHNOLOGY

June 18-20, 2018 | Dublin, Ireland

# e-POSTER

## LIFE CYCLE ASSESSMENT (LCA) AND ECONOMIC EVALUATION OF TREATMENT OF WASTEWATER. COMPARISON OF TWO DIFFERENT PROCESS LINES

**Christos Boukouvalas<sup>1</sup>, V Oikonomopoulou<sup>1</sup>, A Damaskinos<sup>1</sup>,  
M Kafyra<sup>2</sup>, P Stavrakakis<sup>2</sup> and M Krokida<sup>1</sup>**

<sup>1</sup>National Technical University of Athens, Greece

<sup>2</sup>KPAD Ltd., UK

The aim of the current study was the evaluation of the environmental impacts and the economic performance associated with the wastewater treatment in two typical plants. In the first plant, dewatered sludge is subjected to anaerobic digestion and the resulted biogas is treated in cogeneration unit for the production of electricity and heat. The whole process line, including sludge thickening, anaerobic digestion, biomass post-treatment, as well as conversion of biogas to energy was taken into consideration for the evaluation of the environmental performance. In the second plant, the sludge is incinerated for heat production. Sludge thickening and incineration processes were evaluated. The Life Cycle Assessment was carried out using GaBi software. Various environmental impact categories, such as global warming, acidification, eco-toxicity and eutrophication were examined. In parallel, preliminary economic evaluation for the two plants was performed, for the determination of the cost of the various treatment technologies, including operation and maintenance stages. The results of the present study showed different environmental impacts and economic performance for the two plants. The different environmental footprint and cost analysis indicate the importance of choosing the most suitable treatment technology.

## BIOGRAPHY

Christos Boukouvalas is a Laboratory Teaching Staff in the Sector of Analysis, Design and Development of Processes and Systems, School of Chemical Engineering NTUA, Greece. His research interests reflect in his wide range of publications in various national and international journals.

[bouk@chemeng.ntua.gr](mailto:bouk@chemeng.ntua.gr)



Note:



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

# GREEN CHEMISTRY & TECHNOLOGY

June 18-20, 2018 | Dublin, Ireland

# ACCEPTED ABSTRACTS

June 18-20, 2018 | Dublin, Ireland

J Ind Environ Chem 2018, Volume 2 | DOI: 10.4066/2591-7331-C1-003

## INVESTIGATING THE RECALCITRANCE OF BIORESOURCES FOR BIOFUELS

**Arthur J Ragauskas**

University of Tennessee-Knoxville, USA

After a 'slow-start,' we have seen the development of commercial cellulosic-ethanol plants on a global basis employing either the thermochemical or the biological technology platform. Despite these successes, numerous challenges remain which hinder broad acceptance of biofuels which for the biological platform include the recalcitrance of biomass and what to do with lignin. Research studies by our group and others have clearly shown that the recalcitrance of biomass is a multi-tiered effect due to the complex nature of the plant cell wall. On-going studies have shown that the natural variance of the plant-cell wall can influence recalcitrance and chemical pretreatments substantially altering the structure of the cell-wall components further reducing recalcitrance. Analysis of cellulose, hemicellulose and lignin from low and high recalcitrance biomass feedstocks including switchgrass and poplar, before and after chemical pretreatment, is one of the most promising methodologies to investigate and dissect the fundamental mechanisms of recalcitrance. Employing these protocols, we have shown that acidic and neutral pretreatments usually provide a biomass resource with increased crystallinity which is less reactive to cellulose and thereby not a beneficial component to reducing recalcitrance. The loss of hemicelluloses and changes in structure of lignin, during these pretreatments, certainly provides a more reactive biomass for biological deconstruction. Depending on the severity of the pretreatment, lignin undergoes a series of competing depolymerization reactions cleaving  $\beta$ -O-aryl ethers which can then undergo further condensation reactions. Likewise, the cleavage of ester linkages involving p-hydroxyl benzoic and other ester linkages, can decrease the affinity of cellulase to lignin and rupture LLC bonds which are beneficial to reducing recalcitrance. These changes in plant cell polymers also 'open-up' the cell wall structure which increase biomass accessibility and allows greater access to cellulose by cellulases. This presentation will examine how advanced NMR and GPC techniques can be used to investigate the changes in bulk cell wall chemistry and how ToF-SIMS can be used to monitor changes on the surface of biomass before and after pretreatment.

June 18-20, 2018 | Dublin, Ireland

J Ind Environ Chem 2018, Volume 2 | DOI: 10.4066/2591-7331-C1-003

## CAPTURING AND CONVERTING CO<sub>2</sub> TO LOW CARBON EMISSIONS FUELS AND CHEMICALS

**Paul O'Connor, Igor Babich and Sjoerd Daamen**

The University of Texas, USA

Reducing human Carbon (CO<sub>2</sub>) Emissions is a worldwide. Therefore there is a lot of interest for the use of advanced low CO<sub>2</sub> emission fuels such as biofuels and for the introduction of battery powered electrical vehicles charged by renewable energy such as solar, wind, hydro or geothermal power. Lesser known is the concept of converting the power generated by renewable energy directly into zero carbon emissions fuels, also sometimes called "electrical-fuels". It appears that this option may become the fastest and lowest cost transition path to Zero Carbon emissions. The technology to do so is already available and in fact state-of-the art except for the step to economically harvest CO<sub>2</sub> (and water) directly from the air. Direct Air Capture (DAC) of CO<sub>2</sub> will be necessary as in many cases no secure CO<sub>2</sub> point sources are present or will be present in the future at the locations where the lowest cost electricity (to produce Hydrogen) is available. Furthermore it may be prudent not to rely too much on CO<sub>2</sub> point sources of fossil origin to produce zero carbon emissions fuels. ANTECY has developed the crucial technology which still was the missing link to making this possible. Carbon dioxide (CO<sub>2</sub>) is captured from Air and/or existing CO<sub>2</sub> containing gas streams and concentrated to high purity and pressure in order to be converted into liquid hydrocarbons with Hydrogen (H<sub>2</sub>) produced by water-splitting making use of renewable electricity. The unique enabling features of this technology are that it is low cost, requires a low amount of low value heat and above all that it makes use of an environmentally friendly and robust non-toxic solid sorbent system based on Carbonates.



## **BIOMASS AND BIOGAS FOR SUSTAINABLE ENERGY GENERATION: RECENT DEVELOPMENT AND PERSPECTIVES**

**Abdeen Omer**

Energy Research Institute (ERI), UK

**B**iogas from biomass appears to have potential as an alternative energy source, which is potentially rich in biomass resources. This is an overview of some salient points and perspectives of biogas technology. The current literature is reviewed regarding the ecological, social, cultural and economic impacts of biogas technology. This article gives an overview of present and future use of biomass as an industrial feedstock for production of fuels, chemicals and other materials. However, to be truly competitive in an open market situation, higher value products are required. Results suggest that biogas technology must be encouraged, promoted, invested, implemented, and demonstrated, but especially in remote rural areas.



## **BIOMASS CONVERSION TO BIOFUELS AND BIO-BASED PRODUCTS VIA GREEN TECHNOLOGY AND PROCESSES**

**Suzana Y**

Universiti Teknologi PETRONAS, Malaysia

In view of global attention to reduce our dependency on non-renewable resources, extensive efforts have been spurred towards sustainable development and utilization of our natural resources to mitigate the effects of rising global energy demand, due to continuous growth of world population and industrialized economy. This has motivated the utilization and transformation of biomass into useful bioenergy and biomaterials. The speech features sharing of technology and conversion processes from the perspective of sustainability, in line with global established goals and principles, such as Sustainable Development Goals (SDGs) and 12 principles of Green Chemistry. Furthermore, researches on process development and innovation of biomass conversion to various types of biofuels and bio-based products are highlighted. These include studies on liquid fuels, such as biodiesel and bio-oil, derived via esterification, pyrolysis and liquefaction processes. Studies on syngas and solid biochar production with increased calorific values through catalytic gasification and torrefaction, are also presented. Apart from that, biopesticides derived bio-active compounds extracted from plant materials using supercritical fluid extraction and synthesis of novel natural-hydro low-transition-temperature-mixture using malic acid extracted from plants by microwave hydrothermal technology for biomass delignification will be discussed. Intensification technology for biodegradable drilling fluid properties improvement using nanoparticles (graphene nanosheet, carbon nanotube and graphene oxide) are studied and compared. Research on synthesis of renewable diesel from rubber seed oil hydrotreated by novel hydrogen-rich donor solvent is also shared. The development of microporous activated carbon via simplified physical activation from various agricultural and industrial wastes and study on their performance on gas sorption is also presented.



Note:

## **HYDROXY ETHYL SULFONE BASED REACTIVE COALESCING AGENTS FOR WATER BORNE COATING WITH LOW ENVIRONMENTAL IMPACT**

**Ramalingam B, Kaur J, Krishnan R, Jana S and van Herk A M**

Institute of Chemical and Engineering Sciences (ICES), Singapore

One of the successful industrial approaches for making surface coatings with low environmental impact is adopting waterborne formulations. In general, emissions from the waterborne coatings are significantly less in comparison to solvent based coatings. However, present waterborne coatings still use substantial amount of small organic compounds (SOCs) as functional additives for various purposes. Coalescing agent (CA) is one among them and helps to reduce the glass transition temperature ( $T_g$ ) of the binder polymer. However, these CAs are vulnerable to vaporize into the environment (volatile organic compounds, VOCs) and causes environmental pollution and long term health hazards. One of the novel strategies to avoid this issue is to use reactive coalescing agents (RCAs) that and become integral part of the coating during drying process. Facile dehydration of  $\beta$ -hydroxy sulfones present in HES known to form vinyl sulfone, which subsequently reacts with other nucleophilic groups present in other entity. In the present work, we have exploited a similar concept in the development of a series of novel hydroxyl ethyl sulfone (HES) based RCAs. Coalescing performance of HESs were investigated by measuring minimum film formation temperature (MFFT). We found that HES compounds react with alcohol and amine monomers as well as crosslink with polymers during drying process. Preliminary experimental studies indicated that HES undergo 'water-release-triggered equilibrium' reactions through the formation of corresponding vinyl sulfone (VS). The VS intermediate was isolated and characterized for the first time. The details on the HES and VS equilibrium and reactivity of HES with alcohol and amine containing polymers will be presented.

## BIOREFINERY OF WILD CASTOR SEED FOR SYNTHESIS OF GREEN PRODUCTS

**Satya Narayan Naik, Subhalaxmi Pradhan, Bhushan Dole and Devesh Saxena**

Centre for Rural Development and Technology, Indian Institute of Technology, New Delhi

**B**iorefinery is a concept of utilization of bio-based materials in an integrated manner to develop different products from the by-product of one process that can be the feedstock for other. This process is capable of providing a variety of products of various industrial applications from biomass. This paper deals with biorefinery approach of Non-edible oil seed crop Castor to produce different green materials. Castor seed is rich source of oil and due to high viscosity the oil is mainly used for biolubricant production. But the transesterified oil can be better adopted as biolubricant and biodiesel. Castor oil alkyl esters are produced directly for castor seed by reactive extraction (RE). Reactive extraction is both extraction and transesterification of vegetable oil directly from raw agricultural material. Reactive extraction of castor seed was carried out using different alcohols acting as both extracting solvent and transesterification reagent. It was found that the yield of reactive extraction is low in higher alcohols due to decrease in oil extraction efficiency. During RE process measurable amount of cake and glycerol is produced as a by-product. The seed cake is rich in protein and carbohydrates which can be used for bioethanol production and that alcohol will be again utilized in transesterification. Bio-enzymes can be produced by solid state fermentation of cakes. The glycerol obtained during this process is converted to monoglycerides by Glycerolysis reaction. Monoglycerides synthesised by this process can be used as biosurfactants. Utilization of these by-products to value added product will reduce the cost of biodiesel/biolubricant production. So Non-edible oil based biorefinery can be set for production of Biofuels (Bioethanol, Biodiesel) and Bio-products (Biosurfactants, Biolubricants, Bio-enzymes) from Castor seed. So this process will develop a biorefinery technology for production of different green products from castor seed.

June 18-20, 2018 | Dublin, Ireland

J Ind Environ Chem 2018, Volume 2 | DOI: 10.4066/2591-7331-C1-003

## **DETERMINATION AND REMOVAL OF COPPER AND CADMIUM IN DRINKING WATER SAMPLES COLLECTED FROM JIMMA TOWN, SOUTH-WEST ETHIOPIA, USING ACTIVATED CARBON PREPARED FROM PUMPKIN SEEDS**

**Khalid Siraj**

Jimma University, Ethiopia

This study was designed for the determination and removal of heavy metal contaminants in drinking water samples collected from Jimma town, South Western Ethiopia using chemically activated carbon prepared from pumpkin (*Telfairia occidentalis*) seed. The activation was done by heating the mixture in an electrical furnace at 800°C for 3 hrs. Three types of drinking water samples (untreated, treated and distributed) had been collected from six different sites having a total of about twenty one samples. Two heavy metals, copper and cadmium had been studied and their concentration in some of the water samples was found to be (0.3 mg/L for Cu (II) and 0.0072 mg/L for Cd (II)) which was above the maximum permissible levels (MPL) compared to World Health Organization (WHO) limit that is 0.2 mg/L and 0.005 mg/L for copper and cadmium respectively. Adsorption experiments were carried out as a function of pH, contact time, initial Cu (II) and Cd (II) ion concentrations, adsorbent dosage and temperature of the solution for the removal of the ions. The equilibrium data better fitted to the Langmuir isotherm model for studying the adsorption behavior of the ions with correlation coefficient ( $R^2$ ) of  $> 0.999$ . Kinetic studies of the data showed that the adsorption follows the pseudo-second order kinetic model. Thermodynamic parameters  $\Delta G$ ,  $\Delta H$ , and  $\Delta S$  for the uptake of Cu (II) and Cd (II) ions were calculated suggesting that adsorption on the surface of activated carbon was non spontaneous and feasible; and endothermic between temperatures of 25°C and 45°C.

June 18-20, 2018 | Dublin, Ireland

J Ind Environ Chem 2018, Volume 2 | DOI: 10.4066/2591-7331-C1-003

## PREDICTION OF GLUCOSE YIELD AFTER ENZYMATIC DIGESTIBILITY OF PRETREATED BIOMASS

**Michael Ioelovich**

Polymate, Israel

The aim of this research was to predict the glucose yield after enzymatic hydrolysis of pretreated plant biomass using chemical composition and the crystallinity degree of cellulose component. Biomass of various origin were used, such as poplar, switchgrass, bagasse, corn stover, corn cobs, rice and wheat straw. The biomass samples were pretreated using one and two-step pretreatments. Chemical composition of the biomasses was determined by conventional methods of chemical analysis. The pretreated biomass samples were hydrolyzed with a mixture of commercial cellulase Accelerase-1500 (DuPont/Genencor) supplemented with  $\beta$ -glycosidase NS-188 (Novozymes A/S). Conditions of the hydrolysis were the following: biomass loading (BL) was 50 g/L; dose of the cellulase 15 FPU/g sample; temperature 50°C; pH=4.8; duration 24 h. Concentration of glucose (G, g/L) in hydrolyzates was analyzed by HPLC-method. Yield of glucose was calculated as:  $Y(\%) = 100\% G/BL$ . The results showed that lignin-hemicellulose complex affected negatively on enzymatic cleavage of cellulose, whereas increased content of cellulose with decreased crystallinity degree promotes enzymatic hydrolysis. The best correlation ( $R^2=0.98$ ) was discovered for the dependence of glucose yield (Y) on the combined parameter (P):  $Y = 0.96 P + 5$ ; where  $P = 2C(1-X) - 0.5 LH$ , X is crystallinity degree of cellulose, C is percentage of cellulose and LH is percentage of ligno-hemicellulose complex in the pretreated biomass samples. Thus, increased content of cellulose, its reduced crystallinity, as well as decreased content of lignin and hemicelluloses in the pretreated biomass, promote enzymatic saccharification. The discovered correlation  $Y=f(P)$  permits prediction the saccharification degree of the pretreated biomass, which can be used for choice the best pretreatment method. In particular, a nitric acid/alkaline pretreatment of herbaceous plants provides the delignified biomass containing the low-crystalline cellulose having an enhanced enzymatic digestibility and maximum glucose yield.

June 18-20, 2018 | Dublin, Ireland

J Ind Environ Chem 2018, Volume 2 | DOI: 10.4066/2591-7331-C1-003

## CHANGES IN AIR POLLUTION AND ATMOSPHERIC CORROSIVITY IN THE CZECH REPUBLIC-EFFECT ON MATERIALS DEGRADATION

**Katerina Kreislova, Pavlina Fialova, Zdenek Bartak and Jaroslav Skorepa**

SVUOM Ltd., Czech Republic

Airborne acidifying pollutants are known to be one major cause of corrosion of different materials. The most sensitive materials are metals used as structural material of infrastructure and architecture (bridges, roofs, facades, pipeline, etc.) and/or materials of a lot of equipment (computers, electronic and electric instruments, automotive, etc.). The effects of air pollution onto materials degradation are studied since the beginning of last century. The first studies focus on architecture, civil engineering–corrosion and tarnishing of the metals (brass, zinc) used in building [1]. SVUOM specialists were very active in investigation of atmospheric corrosivity since 1950 [2]. World studies performed in period 1930-1990 showed dependence of „unit“ corrosion rate of metal at open atmosphere on SO<sub>2</sub> pollution as the most dominant factor of anthropologic pollution (80%). For this situation a lot of risk management studies had been performed based on dose-response functions allowed to estimate the cost of atmospheric corrosion, resp. air pollution [3]. In Europe the SO<sub>2</sub> pollution significantly decreased since 1990 for ca 70% minimum. It resulted into decreasing of metal corrosion rate, increasing of their durability and service life, reducing metal run-off into surrounding environments, etc.. The atmospheric corrosion is now affected by other factors. After the reduction of SO<sub>2</sub> air pollution the particle matter pollution remains significant in many European regions. Very aggressive dust particles are chlorides even in non-marine regions where the chloride source are de-icing salts. They negative effect not only water (rivers, lakes) and vegetation, but also the exposed materials. The last studies are focus also onto the assessment of the potential impacts of climate change on the atmospheric corrosion. Annual mean temperatures increased during the 1930s, cooled during the 1940s, remained relatively constant until 1975, increased rapidly until 1998 with a net temperature increase of ~0.8 C, and have remained relatively constant until 2011. Besides global warming, there are also changes in other parameters. For example, average annual precipitation increased by nearly 10% over the course of the 20<sup>th</sup> century.



June 18-20, 2018 | Dublin, Ireland

J Ind Environ Chem 2018, Volume 2 | DOI: 10.4066/2591-7331-C1-003

## **COLLOIDAL GAS APHRON (CGA): A NEW TECHNOLOGY TO REMOVE TOTAL CONTAMINANTS INCLUDING OIL FROM PRODUCED WATER USING FROTH FLOTATION**

**Fawzi Banat, Priyabrata Pal and Aiza Gay Corpuz**

Khalifa University of Science and Technology, United Arab Emirates

This research work is related to water scarcity and lack of water resources in the United Arab Emirates as well as finding other alternatives for water resources. It is estimated that 241 million barrels of produced water associated to oil and gas operations is generated globally every day, expected to grow by 21% to 292 million barrels by 2020. With the combined factors of ageing reservoirs, tightening government regulations and new EOR methods, the importance of maintaining a thorough and reliable produced water treatment process is necessity. Development of an efficient, cost-effective, environmental friendly and sustainable water treatment system will have significant and positive outcomes while minimizing the adverse impacts on the environment. The removal of particulates, heavy metals including oil will be the main focus of this research using Colloidal Gas Aprons (CGAs), a new technology for froth flotation. CGAs, can be termed as micro-foam system with colloidal properties and consist of closely packed spherical bubbles. CGAs were generated from anionic (sodium dodecyl benzenesulfonate) and cationic (hexadecyl trimethyl ammonium bromide) surfactants. Stirring speed of 3000 rpm was maintained to produce CGAs containing 500 mL surfactant solutions to obtain average bubble size of 60  $\mu\text{m}$ . The effects of concentration of contaminants, volume of liquid in the flotation column, CGAs loading rate, and pH of solution on the removal of all the contaminants were examined. Flotation column containing 100 nm iron oxide particles having concentrations 400 mg/L and oils of 100 mg/L removed 41% and 96%, respectively. While, maximum removal of 96% for lead and 81% for copper ions were obtained having mixed metal ion concentrations 100 mg/L at pH of 5.35 and CGAs loading rate of 6.1 cm/min. Thus, CGAs using flotation technique is proved to be an effective procedure for the removal of contaminants from produced water.

## **GREEN CHEMISTRY IS THE MAJOR SUSTAINABLE INDUSTRY FOR THE DEVELOPMENT OF HEALTH, BASIC NEED OF LIFE, REDUCES FINANCIAL CRISES, POVERTY AND HUNGER IN THE WORLD**

### **Muhammad Usman**

Former Director General, Agriculture research system, KPK-Pakistan

The aim of presentation consist of green chemistry, health, daily life, crises, poverty and hunger were studied and reported that green chemistry is the major sustainable industry for the development of health, basic need of life, reduce financial crises, poverty and hunger in the world. Chemistry is the science of composition, structure, properties and reaction of a substance, matter and molecular system. Green chemistry is one of the major and sustainable industry consists of design of chemical products and processes that reduce or eliminate the use or generation of hazardous substance. Green chemistry applies across the life cycle of a chemical product including its design, manufacture, use and ultimate disposal. It is also called as a sustainable chemistry, is an area of chemistry and chemical engineering focused on the designing of products and process that minimize the use and generation of hazardous substances. The major principal of green chemistry including prevention, atom economy, less hazardous chemical synthesis, designing safer chemicals, safer solvents and auxiharies, design for energy efficiency, use of renewable feed stocks etc. In the light of the above study, it is concluded that green chemistry prevent pollution, reduce the negative impact of chemical products, eliminate the amount of toxic substance and minimize the hazards of chemical feed stock, It is the major sustainable industry for the development of health, basic need of life, generate income, increase employment, reduce financial crises, poverty and hunger in the world.

June 18-20, 2018 | Dublin, Ireland

J Ind Environ Chem 2018, Volume 2 | DOI: 10.4066/2591-7331-C1-003

## **ADVANCEMENTS IN HYDROTHERMAL PROCESSING OF ALGAL BIOMASS FOR CO-PRODUCTION OF BIOENERGY AND NUTIRENTS**

**Umakanta Jena**

New Mexico State University, USA

**W**ith rapid world population growth, there is a greater need for food, energy and water (FEW). As cities grow, municipality water demands increase and there is increasing demand for treatment of municipality waste water (MWW). While the conventional treatment of MWW is not economically viable, biological remediation using algae biomass growth has been found as a cost-effective solution for treating MWW, recovering N and P nutrients, and generating energy. Algal biomass serves as perfect FEW nexus due to its ability to grow in low-quality water, sequester carbon dioxide and net positive environmental effects. Algal biomass is an excellent feedstock for producing liquid biofuels via hydrothermal liquefaction (HTL). HTL involves conversion of whole, wet algae biomass in hot, compressed water (270-350 °C and 8-18 MPa) into an energy-dense "bio-crude oil" along with other co-products (solid char, gases and aqueous phase). The aqueous phase is rich in N and P nutrients that are recovered via struvite precipitation. HTL can be conducted in both batch and continuous mode operations. While most of the studies world-wide report results from batch HTL conducted in 100-2000 mL pressure reactors, only handful of studies have conducted continuous HTL studies. A continuous flow reactor (CFR) system suffer from several challenges including flow of biomass slurry through pumping/preheating unit/reactor units, clogging of solids, solid-liquid-gas separation/filtration, involvement of a large number of unit operations, and safety and control issues. This presentation provides an overview of the recent progress in batch and continuous algal HTL research and co-product development.