

# JOINT EVENT



8<sup>th</sup> International Conference on  
**Environmental Chemistry and Engineering**  
&  
7<sup>th</sup> Edition of International Conference on  
**Green Energy, Green Engineering and Technology**  
September 20-22, 2018 Berlin, Germany

## Posters

*Environmental Chemistry 2018 & Green Technologies 2018*

8<sup>th</sup> International Conference on **Environmental Chemistry and Engineering**  
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**Control of polymorphism of calcium carbonate compounds in the cementitious materials by pH control**

Heesup Choi and Masumi Inoue  
Kitami Institute of Technology, Japan

Generally, cracking is inherent in reinforced concrete structures and leads to serious damage during its service period. Repeated occurrence of such damages will lead to the enlargement of the cracks, thereby allowing other deteriorating elements such as CO<sub>2</sub> and Cl<sup>-</sup> to further penetrate the concrete, and this can have serious consequences for the concrete structure. On the other hand, in an environment where there is supply of water, concrete structures display "self-healing," in which some of cracks close up naturally, and this phenomenon is closely associated with the hydrates that are newly generated in the areas of crack formation. This study focuses on the type of CaCO<sub>3</sub> crystals generated by the self-healing phenomenon. CaCO<sub>3</sub> is crystal polymorphism and it is reported that crystal forms can be controlled by the relationship of temperature and pH. Generally, CaCO<sub>3</sub> consists of the three kinds, such as calcite, vaterite and aragonite for crystal formation. On the other hand, vaterite is also generated most densely among these, and self-healing can be expected. Therefore, an experiment is made for the purpose of establishing the conditions to generate vaterite. The supplied saturated Ca(OH)<sub>2</sub> solution is used for the effective self-healing. Conditions of the pH are managed pH 9.0-12.0. The results showed that self-healing occurred and the product of the self-healing phenomenon was mostly vaterite to a crystal of CaCO<sub>3</sub> under the condition of pH 9.0. Finally, if we can develop crack resistant concrete or methods for controlling cracks and self-heal cracked concrete, concrete would last longer and become a more sustainable construction material than the standard concrete. This would extend the life of concrete structures and hence potentially lower human CO<sub>2</sub> emissions through improving concrete durability. That is, it is expected that self-healing of concrete can facilitate the maintenance and management of concrete structures, reduce environmental loads, and extend the lifespan of concrete structures.

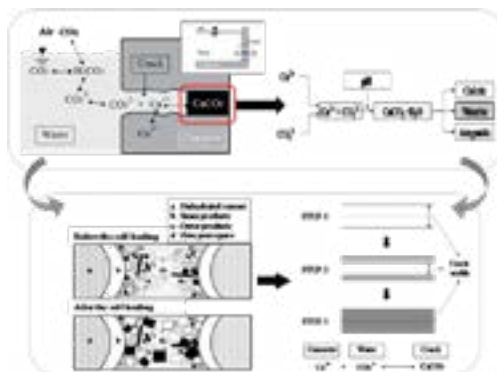


Figure: The self-healing mechanism of concrete.

**Recent Publications**

1. Heesup Choi, Masumi Inoue, Risa Sengoku, Hyeonggil Choi (2017) Control of polymorphism of calcium carbonate compounds produced in cracked part of cementitious materials by self-healing. Journal of applied sciences 7(6):1-16.
2. Heesup Choi, Masumi Inoue, Risa Sengoku, Hyeonggil Choi (2017) Strength recovery of concrete exposed to freezing-thawing by self-healing of synthetic fiber and cementitious materials. Journal of Advanced Materials Letters 8(10):993-998.
3. Heesup Choi, Masumi Inoue, Hyeonggil Choi, Myungkwan Lim, Tomoya Nishiwaki, Kawajiri Shunzo (2016) The fundamental study of the crack control by self-healing of PVA fiber reinforced cementitious composites. Journal of Civil Engineering and Architecture Research 3(9):1680-1688.

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4. Heesup Choi, Masumi Inoue, Sukmin Kwon, Myungkwan Lim, Hyeonggil Choi, Ryoma Kitagaki and Takafumi Noguchi (2016) Mechanical characteristics and recoverability of low-quality crushed coarse aggregate by surface modification and microwave heating. *Journal of Asian Concrete Federation* 2(1):24-30.
5. Heesup Choi, Masumi Inoue, Sukmin Kwon, Hyeonggil Choi, and Myungkwan Lim (2016) Effective crack control of concrete by self-healing of cementitious composites using synthetic fiber. *Journal of the Materials* 9(4):1-14.

### Biography

Heesup Choi has his expertise in evaluation and passion for improving the self-healing of concrete. He has built this technique after years of experience in research, evaluation, teaching and administration both at Tokyo University and Kitami Institute of Technology of Japan. The foundation is based on autogenous healing of concrete which is a methodology of water permeability and autogenous healing of cracks in concrete. It allows for prevention of micro crack by various degradation of concrete.

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**Intensification of mass transfer process using deep eutectic solvents and nanosuspensions**

Anamarija Mitar and Jasna Prlić Kardum  
University of Zagreb, Croatia

In an attempt to reduce the usage of hazardous solvents and procedures in industrial processes, replacement of conventional organic solvents has become an important area of research. Research and application of deep eutectic solvents (DESs) in extraction processes, due to their green character, provide many options and could significantly contribute to the advancement of green technologies and reduce the negative impact of industry on the environment. DESs are applied in the processes of extractive desulfurization and denitrification instead of conventional catalytic processes hydrodesulfurization (HDS) and hydrodenitrification (HDN). These classical processes require high costs due to high temperatures and pressures and the use of considerable amounts of hydrogen and catalysts in the process. Moreover, HDS and HDN aren't very successful in removing cyclic sulfur and nitrogen compounds such as thiophene, dibenzothiophene, carbazole and pyridine. This study examines mass transfer in extraction processes by using DESs and possible improvement of mass transfer with nanosuspensions. It is known that the application of nanosuspensions improves thermal properties as a result of Brownian motion of well dispersed nanoparticles within the suspension. Improvements of mass transfer by diffusion and/or convection can be expected due to heat and mass transfer analogy. The experiments are focused towards preparation of stable nanosuspensions with DESs as base fluids, their implementation and achieving improvements in the extraction of thiophene (sulfur compound) and pyridine (nitrogen compound) from model fuel FCC gasoline. Extractive denitrification proved to be more successful process than extractive desulfurization due to higher solubility of pyridine than thiophene in DESs. Furthermore, extraction with DESs and nanosuspensions showed better performance compared to extraction with conventional solvents.

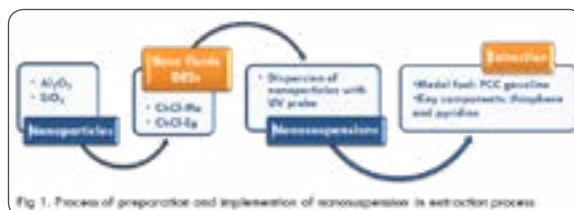


Fig 1. Process of preparation and implementation of nanosuspension in extraction process

**Recent Publications**

- Zhang Q, De Oliveira Vigier K, Royer S and Jerome F (2012) Deep eutectic solvents: syntheses, properties and applications. *Chem. Soc. Rev.* 41:7108-7146.
- Rogošić M, Sander A and Pantaler M (2014) Application of 1-pentyl-3 methylimidazolium bis(trifluoromethylsulfonyl) imide for desulfurization, denitrification and dearomatization of FCC gasoline. *J. Chem. Thermodyn.* 76:1-15.
- Yin J, Wang J, Li Z, Li D, Yang G, Cui Y, Wang A and Li C (2015) Deep desulfurization of fuels based on an oxidation/extraction process with acidic deep eutectic solvents. *Green Chem.* 17:4552-4559.
- Krishnamurthy S, Bhattacharya P, Phelan P E and Prasher R S (2006) Enhanced mass transport in nanofluids. *Nano Lett.* 6:419-423.
- Bahmanyar A, Khoobi N, Mozdianfard M R and Bahmanyar H (2011) The influence of nanoparticles on hydrodynamic characteristics and mass transfer performance in a pulsed liquid-liquid extraction column. *Chem. Eng. Process.* 50:1198-1206.

**Biography**

Anamarija Mitar is a Postgraduate PhD student of Chemical Engineering and Applied Chemistry on Faculty of Chemical Engineering and Technology, University of Zagreb. Her scientific activity began in the development of green technology. Attention is focused on the development of new, environmentally friendly solvents (ionic liquids and deep eutectic solvents) which would satisfy the technological and economic requirements. The areas of her scientific research are thermal separation processes; extraction using green solvents and transport properties of nanofluids.

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**Persistent and emerging pollutants detection on aquacultures oysters (*Crassostrea gigas*) from Northwestern Portugal coast (Ria de Aveiro, Aveiro district)**

Juliana Rodrigues Gadelha<sup>1</sup>, A Cristina Rocha<sup>1</sup>, Carolina Camacho<sup>2</sup>, Ethel Eljarrat<sup>3</sup>, Andrea Peris<sup>3</sup>, Yann Aminot<sup>4</sup>, James W Readman<sup>4</sup>, Vasiliki Boti<sup>5</sup>, Christina Nannou<sup>5</sup>, António Marques<sup>1,2</sup>, Maria Leonor Nunes<sup>1,2,3</sup> and Marisa R Almeida<sup>1</sup>

<sup>1</sup>Universidade do Porto, Portugal

<sup>2</sup>Portuguese Institute for the Sea and Atmosphere, Portugal

<sup>3</sup>Institute of Environmental Assessment and Water Research - CSIC, Spain

<sup>4</sup>Plymouth University, UK

<sup>5</sup>University of Ioannina, Greece

Aquaculture is the most promissory way to produce seafood in large scale and could be an alternative to avoid the excessive predation to the natural populations, such as many fish species (codfish, sardines, tuna, salmon), shrimp, lobster and oyster. But, the water catchment directly to the sea from coastal zones and freshwater, usually used by aquacultures farms, needs to be monitored and investigated in order to ensure the water quality. The present study integrate a multidisciplinary team, responsible to research a wide range of parameters to guarantee the good practices and ensure the good seafood quality to the final consumers. Oyster tissues were analyzed to quantify the polycyclic aromatic hydrocarbons (PAHs), Butyltins (BTs), Organo Flame Retardants, Musks, UV filters, Miscellaneous and Fecal Biomarkers during a complete seasonal cycle. The local water and sediment were also analyzed to give baseline information about the aquaculture real state. The weight and size were also monitored during spring, summer, autumn and winter in order to evaluate which is the best time to consume these much appreciated seafood. Sampling was made on a traditional region of aquaculture activities on Northwestern Portugal coast (Mira Channel, Aveiro district). In general, no significant levels of the analyzed persistent and emergent pollutants were detected. These results are in agreement to the expectation, once that Oysters produced on these regions are largely consumed in Portugal and also in other European countries. So, in general the seafood is safe to human being consumption.

### Biography

Gadelha J R has completed her PhD on Marine Biology/Ecotoxicology in 2015, from Universidade de Aveiro. Currently, she is a Doctoral research integrate at CIIMAR (Interdisciplinary Center of Marine and Environmental Research), working in an emblematic Project funded by Horizon 2020, called INSEAFood: Innovation and valorization of seafood products: meeting local challenges and opportunities. She has published 13 papers in reputed journals and participated on 13 projects, national and international, more than 40 conferences communications and published one book in 2007. On the last decade, she works on environmental risk assessment and applications of biological concepts to biotechnology and environmental safety.

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**Spatial temporal characterization of the water quality of the Vixán lagoon (Northwestern Iberian Peninsula)**

**Juliana Rodrigues Gadelha** and **X L Otero**  
Universidade do Porto, Portugal

The Vixán lagoon is a wetland of high environmental value located on the Galician coast, subject to high anthropogenic pressure. Coastal lagoons show a complex dynamic, where important changes in water chemistry can occur at small temporal and spatial scales, needs the monitoring and knowledge of the chemical processes that occur in them. Space-time sampling campaigns were carried out in collected water samples to analyze: physical-chemical parameters; nutrients; concentration of trace elements and microbiological analysis, in order to create an environmental characterization of Vixán lagoon variations. It verified salinity seasonal variation and a higher electrical conductivity values. Although these values were similar to seawater values, the Vixán lagoon is characterized by a brackish. Also it was detected high pH values due to the increase of CO<sub>2</sub> consumption in the summer months. The O<sub>2</sub> concentrations also varied seasonally, due to the scarce renewal of the surface lagoon waters and the increase of the photosynthetic activity caused by the waters eutrophication. DBO<sub>5</sub> and TOC presented high values. In addition, NO<sub>2</sub><sup>-</sup> and NO<sub>3</sub><sup>-</sup> values were high, probably due to the agricultural fertilizers influence used in the surrounding area. High concentrations of phosphates and spatio-temporal variations of sulphates were also detected. Microbial quality is bad. According to these results, it can be affirmed that the anthropic activity is negative to the lagoon conservation state.

**Biography**

Juliana Rodrigues Gadelha has completed her PhD on Marine Biology/Ecotoxicology in 2015, from Universidade de Aveiro. Currently, she is a Doctoral research integrate at CIIMAR (Interdisciplinary Center of Marine and Environmental Research), working in an emblematic Project funded by Horizon 2020, called INSEAFOD: Innovation and valorization of seafood products: meeting local challenges and opportunities. She has published 13 papers in reputed journals and participated on 13 projects, national and international, more than 40 conferences communications and published one book in 2007. On the last decade, she works on environmental risk assessment and applications of biological concepts to biotechnology and environmental safety.

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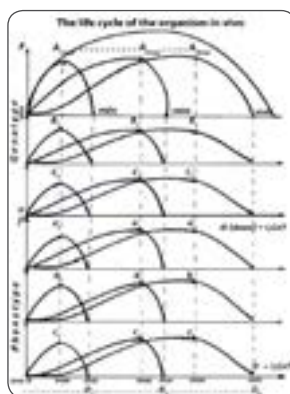
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**Correlation between all the relevant bioprocesses of the genotype and phenotype**

Emma A Tumasyan  
Republic of Armenia

Dosage being result of interaction of two parameters – energy (conditions by agents) and time (dosage) =  $E$  (energy)  $\times$   $T$  (time), as instrument brings about result. Analyses of modeling of results according to the method of dialectics “cause and consequence” reveal a number of patterns: discreteness, continuity, homogeneity, heterogeneity, relativity, discontinuity, abruptness, spontaneity and correlation between genotype and phenotype in the organism *in vivo* that characterize sufficient and necessary factor to approve the quantum theory of *E. Schrödinger* that the mechanism of the biological process *in vivo*. Based on this we can more deeply imagine the relationship between all bio-processes of the genotype and phenotype. It is known that genotypic and phenotypic processes are biochemical, morphological, physiological, etc. All these bioprocesses separately occur with the complete kinetics of frequency rate min-max-min. The relationship between these bioprocesses is due to alternation, discreteness, continuity, relativity, spasmodic nature and correlation, which as a result are revealed by the method of dose-effect -  $D = E_{i,c} \times T$ . Figure 1 presents the genotypic processes: different biochemical processes A1, A2, A3, etc.; different morphological processes B1, B2, B3, etc.; different physiological processes C1, C2, C3, etc. The phenotypic processes are presented: different biochemical processes a1, a2, a3, etc.; different morphological processes b1, b2, b3, etc.; different physiological processes c1, c2, c3, etc. The property of alternation of these bioprocesses is carried out in this way:  $A1 \rightarrow A2 \rightarrow A3$ , etc.;  $B1 \rightarrow B2 \rightarrow B3$ , etc.;  $C1 \rightarrow C2 \rightarrow C3$ , etc.;  $a1 \rightarrow a2 \rightarrow a3$ , etc.;  $b1 \rightarrow b2 \rightarrow b3$ , etc.;  $c1 \rightarrow c2 \rightarrow c3$ , etc., by the effect of doses intervals, respectively [0-D1], [0-D2], [0-D3], etc., which provide discreteness, continuity, relativity, spasmodic nature of these bioprocesses. The dose interval [0-D1] provides the bioprocesses A1, B1, C1, a1, b1, c1, with complete kinetics, at the same time taking frequency rate min-max-min; the dose interval [0-D2] provides the bioprocesses A2, B2, C2, a2, b2, c2, with complete kinetics, at the same time taking frequency rate min-max-min; the dose interval [0-D3] provides the bioprocesses A3, B3, C3, a3, b3, c3, with complete kinetics, at the same time taking frequency rate min-max-min, i.e. the dose interval [0-D] reveals the correlation between the relevant bioprocesses. In sum, we can conclude, that the revealed regularities of the bioprocesses of the genotype and phenotype carry out the life cycle of the organism *in vivo*.



**Figure :** Complete life cycle (min-max-min) occurred by genotypic, phenotypic, physiological bioprocesses which are interrelated by the regularities of discontinuity, continuity, homogeneity, heterogeneity, relativity, successiveness and abruptness.

**Recent Publications**

1. Tumasyan E A (2017) Quantum transfer as a mechanism of the mutation *in vivo*. Science Stays True Here. Biological and Chemical Research 254-264.
2. Djordjevic Y B (2014) Markov chain-like quantum biological modeling of mutations, aging and evolution. Life (Basel) 5(3):1518-1538.



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3. Melkikh A V E (2015) Nonlinearity of quantum mechanics and solution of the problem of wave function collapse. Commun. Theor. Phys. 64(1):47.
4. Namiott V A (2014) The many-worlds interpretation of quantum theory and biophysics fundamental problems. Biophysics 59(1):202-208.

### Biography

Emma A Tumasyan has her expertise in mutagenesis and passion in improving the health detecting numerous drugs that have a mutagenic effect. Besides this she simultaneously studied the mechanism of the biologic process *in vivo*. It has revealed the patterns of biological processes and the relationship between the processes of genotype and phenotype as correlation in the organisms *in vivo* became the basis for the development of quantum nature (!) of the mechanism of biological processes in the organisms *in vivo*. Bearing in mind that she continues to publish works based on the published experimental data obtained by other researchers.

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### New type of buoyancy energy

Hamed Khodayar Sahebi

Islamic Azad University, Iran

Energy has been one of the basic needs of human for their lives, and this need has existed from the very past till today. We always have been used various methods to supply energy from different sources, but some of these methods have been creating environmental problems, including greenhouse gas emissions and global warming. Also on the other hand, limitation of energy sources such as: water resources and fossil fuels, have also led to the use of renewable and clean energies which should be considered and have been used using different methods.

But the barriers and problems of using renewable energies include:

- High cost: High costs of manufacturing, production, installation and utilization
- High technical knowledge: High technology and its proper knowledge for using these types of energies is limited to few countries
- Lack of access: Always there will be some local and temporal restrictions to these renewable energy sources and will not be available easily.

The purpose of this project is to use a new method to produce renewable energy without the use of high-tech manufacturing which will ultimately lead to clean energy production. In the present proposal, it has been considered a new type of renewable energies that has been generated by buoyancy force, and ultimately it transfers to generate energy which is a clean and renewable energy.



Figure: Buoyancy Energy Machine Sample Model

### Recent Publications

1. Irving Herman Shames, Mechanics of Fluids Book, Mcgraw-Hill, 2003.
2. Ferdinand P. Beer, Mechanics of Materials Book, Mcgraw-Hill, 1981.
3. Yunus A. Cengel, Thermodynamics: An Engineering Approach, Mcgraw-Hill, 1993.

### Biography

Hamed Khodayar Sahebi is currently pursuing Mechanical Engineering in Islamic Azad University, Iran. His research focuses on the new type of renewable energy. Recently he has built an experimental model named "Buoyancy Energy Machine" which on testing resulted to generate renewable and clean energy.

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### How much do water efficient products have an impact on reducing water consumption?

Hyun No Kim and A Young Jeong  
Korea Environment Institute, South Korea

According to the UNEP, nearly two-thirds of the countries in the world will suffer from water shortages by 2025, and water shortages in Asia and Europe will be more severe than other areas. In Korea, drought has been occasionally occurred in some areas since 2014. In this context, it is necessary to implement nationwide policy led by the government which would be practicable taking the vulnerability and uncertainty associated with water management into consideration. In the context of increase in spatial and seasonal uncertainty of precipitation due to climate change, water shortages will be likely to occur more frequently. Therefore, various alternative policies which correspond to climate change and water environment will be needed in the future. In previous studies, there has been an ongoing debate about the price increase for water use and its effectiveness to reduce water consumption because the demand for water use in Korea is found to be price inelastic. In addition, imposing higher water prices include political issues, which imply price-based policy as a policy alternative would be inappropriate for a water-saving. In this study, we examine an alternative strategy which increases consumers' willingness to purchase water efficient products as a non-pricing policy. Using the survey data regarding consumers' awareness of water consumption and various policy options that can affect the purchase of water efficient products, we estimated econometric models. We found that policy supporting factors such as certification labeling, free training course, free consulting program have a positive effect on the purchase of water efficient products.

#### Biography

Hyun No Kim has completed his PhD in Agricultural and Resource Economics by the Department of Resource Economics and Environmental Sociology at University of Alberta, Canada. He has published more than 20 papers in reputed journals associated with environmental economics. He is currently working as a research fellow in Environmental Policy Research Group at Korea Environment Institute (KEI).

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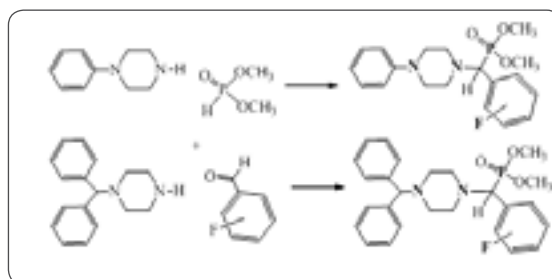
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### Decreasing the synthesis reaction time and toxicity of biologically active hetero (N-, P- and F-) organics using green chemistry

Olzhas Akhmetsadyk, Kaldybay Praliyev, Gulzeinep Begimova, Alexey Zazybin and Valentina Yu  
Kazakh-British Technical University, Kazakhstan

Stimulation of immunity of living organisms (immunocorrection) allows inducing their complex nonspecific resistance to many diseases of fungal, bacterial and viral origin, furthermore to other unfavorable environmental factors. For the purpose of synthetic search of potential immunocorrectors, we have synthesized new  $\alpha$ -aminophosphonates based on 1-phenylpiperazine and 1-benzhydrylpiperidine using classical Kabachnik-Fields reaction conditions. Weak sides of the procedure used for their preparation is the reaction time-24 and more hours and as use of benzene. It turned out that microwave radiation, as expected, significantly reduces the reaction time to 15-25 min. To obtain the target  $\alpha$ -aminophosphonates, 15 min microwave radiation is most effective using BMIB. The effect of magnesium oxide on the reaction with 1-phenylpiperazine is well noticed. The catalytic activity of oxides of magnesium and zinc on formation of the target  $\alpha$ -aminophosphonates under 25 min microwave irradiation is shown. The lower yields of the products of benzhydryl derivatives, both in classical and microwave conditions, can be explained by the steric hindrance created by the benzhydryl group. In addition, microwave radiation lets to exclude use of benzene from the synthesis. The anesthetic properties and toxicity level were studied at National Medicinal University, in Almaty, Kazakhstan. These studies showed that synthesized organics have superior lethal dose concentration, higher anesthesia index and more effective infiltration and conductive anesthesia parameters when compared to known marketed local anesthetics.



Scheme for the Kabachnik-Field reaction for the synthesis of  $\alpha$ -aminophosphonates

#### Recent Publications

1. Begimova G U, Akhmetsadyk O E, Praliyev K D and Yu V K (2016) Dimethyl[(3,4-dimethoxyphenyl)(4-phenylpiperazine-1-yl)methyl]phosphate: synthesis and structure // Chemical Journal of Kazakhstan 1:179-184.

#### Biography

Olzhas Akhmetsadyk has completed his Graduation at Middle East Technical University in Ankara, Turkey. He is working as a Head of Medical Devices Testing Laboratory of National Center for Expertise of Medicines and Medical Devices, Ministry of Healthcare of Republic of Kazakhstan. His recent duties as a Medical Devices Regulator are to evaluate the quality management system of manufacturers upon registering their products in Kazakhstan and to assess the quality of the products according to quality specifications. His research interests include synthesis of bio-active (P-, N- and F-) heterocycles,  $\beta$ -cyclodextrin complexes with bio-active substances, NMR and X-ray studies of cyclodextrin complexes, biocompatibility of cyclodextrin complexes and microbial activity of cyclodextrin complexes.

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## Photovoltaic solar energy: The Brazilian reality

Renato N C Sakamoto  
Universidad Camilo José Cela, Spain

The search for diversification of energy resources in Brazil has become extremely necessary due to two main factors. The first is the current water situation that the country is going through; with the scarcity of rain the generation situation through hydroelectric power plants was compromised. Since the significant reduction in rainfall, power generation by hydroelectric plants has not been sufficient to supply the demand. Therefore, the need to use thermoelectric power plants has caused the price of energy to increase. Secondly, the exploitation of renewable energy resources that brings more comfort, security, flexibility and sustainability. In this scenario, photovoltaic solar energy presents itself as a technology in constant advance in Brazil and around the world. Through a bibliographical review, this article aims to present the principle of the use of this energy, considering the equipment and materials applied to the system, as well as the efficiency they can achieve. In addition, there is a broader view of the use of sunlight to produce electricity through photovoltaic panels and the applications of this technology in specific situations, such as installation on streetlights. The use of photovoltaic energy is a reality that states increasingly in several countries. In Brazil the manufacturing of photovoltaic systems need to reach an industrial scale to reduce costs, technical conditions and the uncertainty of the extent that this market will reach in the coming years also bring difficulties to final consolidation of solar photovoltaic generation in Brazil. There are several uses for a system that generates electricity through solar modules, as in the battery bank and off and on grid systems.

Tipo	Quantidade	Potência		%
		Outorgada (kW)	Fiscalizada (kW)	
COH	668	621.735	623.971	0,39
COG	1	50	50	0
EOL	510	12.532.539	12.509.743	7,91
PCH	429	5.070.129	5.042.723	3,19
UFV	87	1.084.662	1.050.302	0,68
UNE	218	101.883.450	95.619.465	60,44
UTE	2.091	42.722.019	41.348.180	26,13
UTH	2	1.990.000	1.990.000	1,26
Total	4.916	165.904.584	158.214.417	100

Figure 1: Energy generation ventures in operation in Brazil (2018)

### Recent Publications

1. Fraidenraich, n. Comparison of the performance of PV water pumping systems driven by fixed, tracking and V-through generators. *Solar Energy*, London, v. 76, n. 6 p. 703-711, 2004.
2. Cresesb. *Energia solar: princípios e aplicações*. Rio de Janeiro: CEPEL, 2008. 28 p. Disponível em: <[http://www.cresesb.cepel.br/tutorial/tutorial\\_solar.pdf](http://www.cresesb.cepel.br/tutorial/tutorial_solar.pdf)>. Acesso em: 12 setembro 2008.
3. Fraidenraich, n.; vilela, O.C. Performance of solar systems with non-linear behavior calculated by the utilizability method: application to PV solar pumps. *Solar Energy*, London, v. 69, n. 2, p. 131-137, 2000.
4. Grupo de trabalho de energia solar fotovoltaica. *Manual de engenharia para sistemas fotovoltaicos*. Rio de Janeiro: CRESESB, 204 p, 1999.
5. Hinrichs, r.; kleinbach, m. *Energia e meio ambiente*. São Paulo: Pioneira Thompson Learning, 543 p, 2003.

### Biography

Renato N C Sakamoto has completed his Bachelor's degree in Electrical Engineering, graduate studies in Safety Engineering and a Master degree in Renewable Energy. He has four years of experience in the field of Photovoltaic Generation and Power Distribution Networks.

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**Fungal pectinases: Applications in textile and ethanol industries**

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**P**ectinases are a group of enzymes that break down complex polysaccharides of plant tissues into simple molecules such as galacturonic acid. These enzymes hold a leading position in commercialization for industrial applications. Current commercial pectinases are obtained from microbial sources, which result in ecofriendly tools with more specific and energy saving for various industries such as textile and biofuel. Identified enzymes are classified based on their catalytic activities to pectin or its derivatives. The presentation will cover the discovery and isolation methods of pectinases from microbial sources, as well as the use of molecular biology to overexpress the enzymes. The enzyme production, based on DOE method for cost-effective mixture, will also be discussed.

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**Synthesis of photo-polymerizable keratin from bird feather**

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**Statement of the Problem:** Keratin is a family of fibrous proteins found in nature as the major component of wool, hair, horn, nail and hoof of mammals and birds feather. The disulfide crosslinks in combination with other structural features like crystallinity and physical interaction between the  $\beta$ -sheets impart high strength to feather. Due to its high strength and biocompatibility, membranes, sponges and fiber meshes have been produced from keratin. In this work, we describe the synthesis of a photo-polymerizable hydrogel for cell encapsulation based on the keratin extracted from barbs and barbules of chicken feather. The novelty is the synthesis of keratin allyl thioether macromer (KeratATE), based on the keratin extracted from feather that can be dissolved in aqueous cell suspension, injected, and photo-polymerized to generate hydrogels for surface coating and medical applications. Since keratin is rich in cysteine residues, s-allyl modification of sulfhydryl groups was used to functionalize keratin for chemical crosslinking.

**Methodology:** Keratin was extracted from feather barbs by reducing the disulfide bonds in cysteine residues to sulfhydryl groups (-SH) (Figure). Next, the free thiol groups were converted to dehydroalanine (Dha) by oxidative elimination using O-(2, 4, 6-Trimethylbenzenesulfonyl) hydroxylamine. Then, the Dha moieties were converted to s-allyl cysteine by reaction with allyl mercaptan to produce keratin allyl thioether (KeratATE) biopolymer. Conversion of allyl mercaptan before and after allylation reaction was quantified by 5, 5'-dithiobis (2-nitrobenzoic acid) (DTNB) test. The secondary structure of the extracted keratin before and after allylation was determined by circular dichroism and infrared spectroscopy. Molecular weight and purity of the extracted keratin was measured by gel electrophoresis and dialysis. Crosslinking kinetics and gelation point of KeratATE was measured by rheometry. Degradation of the crosslinked keratin was measured in aqueous solution supplemented with collagenase or trypsin.

**Findings:** The freeze-dried photo-crosslinked KeratATE hydrogels had a porous, interconnected, honeycomb microstructure. The compressive modulus of the hydrogels ranged from 1 to 8 kPa depending on KeratATE concentration. Degradation of KeratATE hydrogel was strongly dependent on trypsin concentration but independent of collagenase.

**Conclusion:** Keratin allyl thioether derived from feather is a viable alternative to collagen based biopolymers as a photo-polymerizable gel with controllable degradation for medical applications.

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**The environmental disasters and related counter measure in Northeast Asia regions**

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For a long time, earth's climate change has led to the deterioration of the global environment. Not matter land disasters or marine disasters have increased, and the extent of impact or damage caused has also significantly enlarged. Countries located in northeast Asia not only cannot eliminate this kind of effect, but also, due to their geographical location, are even more seriously affected by natural disasters compared to other countries. Since environmental disasters in northeast Asia are quite similar, therefore, either to exchange cross-border experience of disaster prevention and mitigation or to collaboratively research and develop the best related technology can be the future direction of regional cooperation. Moreover, to apply big data analysis in disaster prevention and mitigation will be a developing tool. Finally, from the aspect of engineering disaster prevention and mitigation, it hopes that risk management should be taken into consideration before facing with the events of natural disasters. This will be more effective and practical to deal with environmental disasters.

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**Green electronics: Biodegradable, biocompatible, bioresorbable materials and devices for sustainable future**

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Portable electronics users tend to upgrade their devices much more frequently as new technologies offering more functionality and more convenience become available. For example, cell phone users tend to buy new cellphones every 2 to 3 years. Thus, large quantities of working electronics are discarded constantly as new ones are available. A report published by the U.S. Environmental Protection Agency in 2012 showed that about 152 million mobile devices are discarded every year, of which only 10 percent is recycled—a legacy of waste that consumes a tremendous amount of natural resources and produces a lot of trash made from expensive and non-biodegradable materials like highly purified silicon. This will not only lead to a large amount of consumption of our limited natural resources but also generate a large amount of waste that could pollute our environment. Thus, it would be desirable to develop a technique for creating electronics using an alternative substrate that is inexpensive and biodegradable or even compostable while maintaining high-performance standards. This will not only drastically reduce the usage of Si but also reduce the accumulation of persistent waste. In recent years, there are several attempts to overcome such issues by employing bio-compatible materials in substrate or device. Such devices or substrates are made out of biodegradable or bioresorbable materials such as cellulose fibers, polymers. Thus, bio-degradable or resorbable electronics will protect our environment by reducing the volume of electronic-waste.

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**Catalytic dehydration of modified carbohydrates as a new approach to efficient biomass utilization in organic synthesis**

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Integration of renewable bio-resources for sustainable applications is one of the key challenges of modern chemical science and technology. The most perspective approach to the synthetic utilization of plant biomass involves the catalytic conversion of carbohydrates to low-molecular-weight building blocks, which are defined as bio-based platform chemicals. 5-(Hydroxymethyl) furfural (HMF) is one of the key platform chemical that can be used for a wide range of applications. Low stability and difficult isolation process limits utilization of HMF as a reagent in organic synthesis (Figure 1, a). This presentation will introduce an efficient approach to the preparation of stable HMF analogues by direct conversion of modified carbohydrates (figure 1, b). A highly efficient biomass conversion process based on introduction of a silyl protecting group to glucose allowed to significantly increase the selectivity of furan formation and facilitated its isolation from the reaction mixture. New aspects of synthesis and utilization of HMF and derivatives for biofuels, materials and pharmaceuticals production were also described. We have shown that the aldehyde group in HMF can be easily modified into an alkyne fragment using the Ohira-Bestmann reaction. A number of polyunsaturated products from alkynyl furans were prepared using rhodium catalysis. The first example of the Diels-Alder reaction of un-substituted 2, 5-bis (hydroxy methyl) furan with maleimide was carried out under green conditions with high diastereo selectivity. The implementation of described synthetic approaches opens new opportunities for the synthesis of demanded functional derivatives from bio-based furans.

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**Economic and environmental prospects of biofuels in the European transport sector**

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Decarbonization of the transport sector as proclaimed in the COP 21 targets requires the transition from fossil to renewable energy sources. While electric vehicles may become a viable option towards decarbonization of individual car traffic, at least aviation, shipping and heavy duty transportation will continue to rely on liquid fuels. Biofuels can replace a large share of fossil fuel in these sectors. However, the usage of biofuels within transportation is only reasonable with significantly reduced Greenhouse gas (GHG) emissions compared to fossil fuels and lower GHG abatement costs compared to other decarbonization technologies (e.g. Power-to-Liquid, hydrogen, electric mobility etc.). A detailed discussion of biofuels prospects in Europe shall be presented. Different biofuel production paths are compared and analyzed in terms of technical potential, fuel costs, GHG footprint and GHG abatement costs. Based on the results the following superordinate questions are addressed: What share of the European transportation energy consumption can be covered by biofuels? In which sector seem biofuels most realistic and most feasible and what type of biofuels are required? How compare biofuels GHG abatement potential and GHG abatement costs with other GHG reducing technologies? A standardized techno economic assessment method was applied out in order to calculate the fuel production costs of the most promising biofuel routes. The methodology was adapted from a best-practice cost calculation standard from the chemical process industry and built up in the in-house cost estimation tool TEPET (Techno Economic Process Evaluation Tool). With transparent cost data input a reliable prediction of current net production costs of alternative fuels is achieved, what is automatically linked to the steady state PFD simulation? The impact of economic boundary conditions such as plant location, biomass price, key equipment costs and economy of scale can be demonstrated.

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**Numerical and experimental studies on movable offshore wind turbine foundation**

**Ray-Yeng Yang**

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Due to the consideration of a great fleet of large ships needed for constructing offshore wind turbines not already been established in Taiwan, one concept is currently developing a novel “float-out, sink and retrieve” offshore installation method for offshore wind turbines. The concept is to construct the gravity base support structure for the wind turbine, assemble the wind turbine and complete functionality testing at the dock, prior to towing the installation to location. The proof-of-concept for this innovative movable type foundation was confirmed by conducting a series of interdisciplinary studies, including numerical simulation and laboratory tests. Safety condition for the towing process of the movable foundation in the sea site was investigated in the towing tank (150m x 8m x 4m) at the NCKU in advance. Then the stability during the installation of the foundation and the dynamic response of the foundation after it is settled firmly were studied and investigated by means of numerical simulation and small scale physical modeling tests. From further movable bed laboratory experiment, the maximum scour depth around the foundation under wave and current action was also obtained. Thus this study furtherly showed the concept has an added advantage that it will allow for retrieval or re-positioning of the foundation without the use of heavy vessel or other specialist offshore installation vessels.

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**The importance of traditional ecological knowledge and indigenous knowledge for sustainability and green practices**

**Samantha Chisholm Hatfield**  
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**Statement of the Problem:** Traditional Ecological Knowledge (TEK), Indigenous Knowledge (IK) is vital aspect often sorely overlooked worldwide. IKs have vast depth informational systems that provide aspects which often transcend western science methodology. Sustainability for Indigenous groups is vital, and means survival not only for the short term, but additionally continued presence in the area for the long term. These Indigenous groups are often the first to notice changes and make alterations to the mannerisms and applications for lifestyles and practices. Indigenous groups have been increasingly tapped for their knowledge about environmental adaptation measures, because of their excellence in sustainability and green practices. These efforts have been the same green practices behaviors which have been assisting and facilitating maintenance and reciprocal relationships with the earth and natural resources so that continuation can continue in the least restrictive and damaging aspects for the Peoples, as well as the earth.

**Methodology & Theoretical Orientation:** Using social science methodologies that have included participant in-depth interviews led to new, unique findings.

**Findings:** Indigenous systems contain a wealth and depth of information, particularly cueing in on climate change effects and adaptation measures faster than non-Indigenous communities because of the exceptionally close connection to the land. Identifications of issues, as well as responses have been shown to be more reliable than the applied western scientific methods.

**Conclusion & Significance:** Holistic systems that are commonly traditional contain information that can benefit and assist communities worldwide, as well as those who rely on commonly utilized western-scientific methodologies. Recommendations are made for incorporating further IK and TEK methodologies for a better utilization addressing issues for improved and ongoing greening efforts.

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**Young's bargaining model for optimal design of groundwater *in-situ* bioremediation**

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Optimization problem with groundwater quality issues can be considered with different objective functions. These objectives cause conflicts between different stakeholders that have conflicting goals. Young's bargaining model is one of the game theories that can be used to find the best design from a set of optimal solutions. In this paper, the optimal *in-situ* bioremediation design for contaminated groundwater with dissolved hydrocarbon is obtained by minimizing the total cost and the square of cleanup standard violation (SCSV). After the optimal solutions were extracted by applying the non-dominated sorting genetic algorithm (NSGA) II, Young's bargaining model was used to select the best alternative. Results show that the selected solution by Young's model is the most optimal combination of two objective functions considered in this study. This solution decreases the cost of project as much as 78.85%. This cost reduction will increase the violation of cleanup standard as much as 25.86%.

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**Evaluation of novel thermo tolerant haloalkaliphilic bacterium *Halomonas stevensii* for biomitigation of gaseous phase CO<sub>2</sub>: Energy assessment and product evaluation studies**

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Present work deals with the bio-mitigation potential of gaseous phase CO<sub>2</sub> by chemolithotrophic bacterium *Halomonas stevensii* isolated from haloalkaliphilic habitat using thiosulfate ion (S<sub>2</sub>O<sub>3</sub><sup>2-</sup>) as an energy source. *H. stevensii* was tested for various abiotic stress tolerance such as salt [1 - 14% (%w: v)], temperature (35-80oC) and pH (4-12). Batch studies were conducted for 6 days at 15 (±1) % (% v:v) inlet CO<sub>2</sub> concentration to find the CO<sub>2</sub> fixing capability of *H. stevensii* under varying concentration of energy substrate i.e. 0, 50 and 100 mm Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>. Approximately 98% CO<sub>2</sub> removal from gaseous phase was achieved at 50 and 100 mm Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>. Biomass productivity was estimated in terms of maximum biomass productivity (P-Max) and specific growth rate (μMax). 6th day sample (biomass and supernatant) obtained from 100 mm Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> batch study was characterized by FTIR and GC-MS to identify the products formed from CO<sub>2</sub> fixation. The evaluation of CO<sub>2</sub> fixation by *H. stevensii* into primary metabolite was carried out by growing the *H. stevensii* at 5%, 10% and 15 % (% v: v) inlet CO<sub>2</sub> concentration for the duration of 6 days. The obtained leachate was further analyzed by GC for the quantification of fatty alcohols. The utilization of gaseous phase CO<sub>2</sub> by *H. stevensii* is also proven by conducting the approximate materials balance and energy assessment for the present CO<sub>2</sub> fixation process.

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