Shizuoka University

IAA
INTER ACADEMIA ASIA

Inter-Academia Asia 2015

The 2nd Conference

Inter-Academia Asia : The 2nd Conference
Young researchers Conference 1 December, 2015
At: Granship, Shizuoka

Tuesday, December 1, 2015				
10:00-10:05	Opening remark (Room 1001)			
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11:30-12:30	Lunch Break			
12:30-13:30	**Poster session (Room 1001)**			
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14:10-14:30	Oral 7		Oral 20	
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Inter Academia Asia The 2nd Conference, December 2015

Young Researchers Conference

Tuesday, December 1, 2015
at Granship (Shizuoka), organised by Shizuoka University

10:00 **Opening Remark**

Oral Presentations

(Total: 26)

ROOM 1002

Engineering

Chair: Prof.Muthamizhchelvan Chellamuthu (SRM University, India)

		Abstract page
10:10 **O1-Engi -P20**	**Influences of bubble interface contamination on bubble motions, bubble wakes, and instantaneous mass transfer** Jie Huang1 & Takayuki Saito2 (1Graduate School of Engineering, Shizuoka University: 2 Research Institute of Green Science and Technology, Shizuoka University)	1
10:30 **O2-Engi -P21**	**Time Frequency Representation of Audio Signal with 2T-EMD based Hilbert Spectrum** Kazi Mahmudul Hassan and Md. Ekramul Hamid (Department of Computer Science and Engineering, University of Rajshahi, Bangladesh)	2
10:50 **O3-Engi -P23**	**Investigation of a relationship between components of dissolved gases and shapes of ultrasonic particle flocculation in water** Sayuri Yanai1, Koji Nomata2, Hiroya Muramatsu3, Yuki Mizushima3, Takayuki Saito4 (1Graduate School of Engineering, Shizuoka University 2Faculty of Engineering, Shizuoka University 3Graduate School of Science and Technology, Shizuoka University 4Research institute of Green Science and Technology, Shizuoka University)	3
11:10 **O4-Engi -P24**	**Effects of Heat Treatment on the microstructure and Properties of AlxCrFeMoySiTi Hea by High Energy Ball Milling** Balaguru. R1 , Sheela Singh2 (1,2 SRM University, Chennai , India)	4
Lunch Break 11:30-12:30		
Poster Session 12:30-13:30		
13:30 **O5-Engi -P22**	**Photosensitized oxidation damage of protein and amino acids by phosphorus(V)porphyrins and their binding states** Dongyan Ouyang1, Shigetoshi Okazaki2, Kazutaka Hirakawa1 (1 Department of Optoelectronics and Nanostructure Science, Graduate School of Science and Technology, Shizuoka University 2 Medical Photonics Research Center, Hamamatsu University School of Medicine)	5

ROOM 1002

Science : 1

Chair: Dr.Adi Pancoro (Institut Teknologi Bandung, Life Sciences and Technology: ITB, Indonesia)

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14:10 **O7-Sci -P27**	**Effects of indirect action by Gamma-rays to survival rate in Tardigrades** TOSHIYOSHI MIYAZAWA1, YASUHISA OYA2 (1 Graduate School of Science and Technology,Educational Division, Shizuoka University 2 Graduate School of Science, Shizuoka University)	7
14:30 **O8-Sci -P29**	**Effects of thermal annealing under/after heavy-ion irradiation on deuterium retention in W** S. Sakurada1, K. Yuyama1, Y. Uemura1, H. Fujita1, C. Hu2, T. Toyama3, T. Hinoki4, S. Kondo4, N. Yoshida5, T. Chikada1, Y. Oya1 (1Graduate School of science, Shizuoka University 2Faculty of Science, Shizuoka University 3Institute for Materials Research, Tohoku University 4Insitute of Advanced Energy, Kyoto University 5Insitute for Applied Mechanics, Kyushu University)	8
14:50 **O9-Sci -P26**	**Effect of viruses on the evolution of bacteria** Lai Yuet Ha (Hong Kong University of Science and Technology)	9
15:10 **O10-Sci -P30**	**Helium fluence dependence on deuterium gas permeation behavior in tungsten** Y. Uemura1), K. Yuyama1), S. Sakurada1), H. Fujita1), H. Cui2), Y. Hatano3), N. Yoshida4), T. Chikada1) and Y. Oya1) (1) Graduate School of Science, Shizuoka University 2) Faculty of Science, Shizuoka University 3) Hydrogen Isotope Research Center, University of Toyama, 4) Research Institute for Applied Mechanics, Kyushu University)	10
15:30 **O11-Sci -P33**	**Dependence of irradiation defect distribution on deuterium retention behavior in damaged tungsten** H. Fujita1), K. Yuyama1), Y. Uemura1), S. Sakurada1), C. Hu2), M. Ohta3), K. Ochiai3), T. Chikada1) and Y. Oya1) (1Graduate School of Integrated Science and Technology, Shizuoka University 2 Faculty of Science, Shizuoka University 3 Japan Atomic Energy Agency)	11
15:50 **O12-Sci -P31**	**Effect of carbon implantation on deuterium retention behavior for damaged tungsten** K. Azuma1, K. Yuyama2, Y. Uemura2, S. Sakurada2, H. Fujita2, C. Hu1, Y. Hatano3, N. Yoshida4, T. Chikada2, Y. Oya2 (1 Faculty of Science, Shizuoka University 2Graduate School of Science, Shizuoka University 3 Hydrogen Isotope Research Center, Univ. of Toyama 4 Research Institute for Applied Mechanics, Kyushu University)	12
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ROOM 1003

Science : 2

Abstract page

Chair: Prof. Mohammad Ekramul Hamid (University of Rajshahi, Faculty of Engineering)

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10:30 **O15-Sci -**	**Development of ceramic-metal multilayer coatings for fusion reactor fuel systems** S. Horikoshi1), J. Mochizuki1), C. Hu1), Y. Oya2) and T. Chikada2) (1Faculty of Science, Shizuoka University 2 Graduate School of Science, Shizuoka University)	15
10:50 **O16-Sci -**	**Antimicrobial peptide Lactoferricin B-induced permeation of fluorescent probes in single giant Unilamellar vesicles** Md. Moniruzzaman1, Jahangir Md. Alam2, Hideo Dohra3, and Masahito Yamazaki1, 2, 4, (1Integrated Bioscience Section, Graduate School of Science and Technology, Shizuoka University 2Nanomaterials Research Division, Research Institute of Electronics, Shizuoka University 3Research Institute of Green Science and Technology, Shizuoka University 4Dept. of Physics, Faculty of Science, Shizuoka University)	16

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Agriculture

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Chair: Assoc. Prof. Somchai Chakhatrakan (Thammasat University, Faculty of Science and Technology)

11:10 **O17-Agri -**	**Effect of water stress on growth and yield quality of Khao Dawk Mali 105 and Hawm Suphan Buri 1** Vatanee Wattanadatsaree a, Somchai Chakatrakarn a and Ornprapa Aungoolprasert b* (a Department of Agricultural Technology, Faculty of Science and Technology,Thammasat University, bMajor of Organic Farming Management, Faculty of Science and Technology,Thammasat University, Thailand)	17
Lunch Break 11:30-12:30		
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13:50 **O19-Agri -**	**Efficacy of High Quality Organic-Fertilizer on Growth and Yield of Purple Riceberry in Different Soil Series** Naruemon Sukkasame a, Ornprapa Aungoolprasert a* and Phakpen Poomipan b and Voraphat Luckanatinvong b (aMajor of Organic Farming Management, Faculty of Science and Technology,Thammasat University, Thailand bDepartment of Agricultural Technology, Faculty of Science and Technology,Thammasat University)	19
14:10 **O20-Agri -**	**Inhibitory effect of foodborne bacteria by metabolites from Lactic acid bacteria** Thitiporn Janyaphisan and Jomkhwan Meerak (Department of Biology, Faculty of Science, Chiang Mai University, Thailand)	20
14:30 **O21-Agri -**	**Gene expression analysis of Chalcone Synthase and Isoflavone Synthase in Local Black Soybean** Dadang Sumardi1, Tati Suryati Syamsudin1, Adi Pancoro1, and Agung Karuniawan2, (1School of Life Science and Technology, Institut Teknologi BandungIndonesia, 2Faculty of Agriculture, Universitas Padjadjaran)	21

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Humanities & Social Sciences

Chair: Prof. Bambang Wibawarta (University of Indonesia,Japanese Studies)

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15:10 **O23-Soc.Sci -**	**Implicit Persona Pronoun 'Watashi': A Study on University of Indonesia Japanese Studies Students Taking Japanese 1 Lecture** C. R. Prameswari (University of Indonesia, Indonesia)	23
15:30 **O24-Soc.Sci -**	**High School Student's Textbooks in Japan: Territorial Controversies** Rumi Sato (Graduate School of Humanities and Social Sciences, Area Studies of Language and Culture, Shizuoka University)	24

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Chair: Danzan Nyamjav (Mongolian National University of Education, Educational Research Center)

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15:50 **O25-Edu -**	**Motivation in foreign Language Learning in Mongolia** Jargalsaikhan Jambalsuren1, Nyamjav Danzan2 (1Researcher, Mongolian National University of Education, Mongolia 2Professor, Mongolian National University of Education)	25
16:10 **O26-Edu -**	**A Study of Disaster Prevention Education to Develop the Ability to Think** Takashi Shimura1 , Motoki Fujii2 (1Division of Advanced Practice in School Education, Shizuoka University 2Department of Education, Shizuoka University)	26

Poster Presentations

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ROOM 1001
12:30-13:30

Engineering

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Engi -P2	**Novel factors related to biofilm formation in Escherichia coli.** A. Nagao, Y. Hasegawa, K. Suzuki, Y. Inuzuka, H. Futamata, Y. Tashiro (Applied Chemistry and Biochemical Engineering Course, Department of Engineering, Graduate school of Integrated Science and Technology, Shizuoka University)	28
Engi -P3	**Isolation of nitrifying microorganisms grown on a low concentration of ammonium from the eutrophied brackish lake Sanaru** K. Sugiyama1, T. Uchino2, S. Sakaya2, Y. Tashiro1,2, H. Futamata1,2 (1Department of Applied Chemistry and Biochemical Engineering, Graduate School of Engineering, Shizuoka University 2 Department of Material Sciences and Chemical Engineering, Shizuoka University)	29
Engi -P4	**Characterization of Rechargeable Minerals Produced by Microorganism** A. Yui1, H. Kubota1, H. Mochihara1, K. Suzuki2, A. Ochi3, T. Kogure4, Y. Tashiro1, 3 and H. Futamata1, 2, 3 (1Department of Applied Chemistry and Biochemical Engineering, Graduate School of Engineering, Shizuoka University 2Department of Enginnering Graduate School of Integrated Science and Technology, Shizuoka university 3Department of Material Science and Chemical Enginnering, Shizuoka university 3Department of Earth and Planetary Science, Graduate School of Science, The University of Tokyo)	30
Engi -P5	**Protein damaging mechanism of phenothiazine photosensitizers** Takaya Ishikawa and Kazutaka Hirakawa (Department of Applied Chemistry and Biochemical Engineering, Graduate School of Engineering, Shizuoka University)	31
Engi -P6	**Oxidation of nicotinamide adenine dinucleotide photosensitized by diethoxy P(V)porphyrins** Atsushi Murata and Kazutaka Hirakawa (Department of Applied Chemistry and Biochemical Engineering, Graduate School of Engineering, Shizuoka University)	32
Engi -P7	**Photo-irradiated folic acid can induce protein damage** Masashi Minamihori and Kazutaka Hirakawa (Department of Applied Chemistry and Biochemical Engineering, Graduate School of Engineering, Shizuoka University)	33
Engi -P8	**Feasibility of Atmospheric Argon Plasma For Improving Transdermal Drug Absorption** N. A. Tran1, J. Kristof2, M. Blajan3, K. Shimizu1,2,3 (1 Graduate School of Engineering Shizuoka University 2 Graduate School of Science and Technology, Shizuoka University 3 Organization for Innovation and Social Collaboration, Shizuoka University)	34

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Engi -P10	**Influences of bubble-surface contamination on bubble motion, bubble-induced surrounding liquid motion and mass transfer** Yuki Iburi1, Takayuki Saito2 (1 Graduate School of Integrated Science and Technology, Shizuoka University 2 Research Institute of Green Science and Technology, Shizuoka University)	36

Poster session will include :
O1-Engi -P20 Jie Huang, O2-Engi -P21 KAZI MAHMUDUL HASSAN, O5-Engi -P22 Dongyan Ouyang, O3-Engi -P23 Sayuri Yanai & O4-Engi -P24 Balaguru Raji,
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Science

Abstract page

Sci -P11	**Potential Description of α+90Zr Elastic Scattering Using Modified Single-Folded Potentials.** S.M. Al Imran Hossain1, 2, M.N.A. Abdullah1 (1Department of physics, Jagannath University, Bangladesh 2Graduate School of Science & Technology, Shizuoka University)	37
Sci -P12	**The Formation of Bipolar Pulsed Arc Discharge For the Efficient Production of Single-Walled Carbon Nanotubes** K. H. Maria1'2, T. Mieno2 (1Department of Physics, University of Dhaka, Bangladesh 2Graduate School of Science and Technology, Shizuoka University)	38

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See oral presentation section for their titles.

Agriculture

Education

Humanities & Social Sciences

Poster session will include : O22-Soc.Sci -P25 TA THI THU HANG. see oral presentation section for their title.

Abstract

Influences of bubble interface contamination on bubble motions, bubble wakes, and instantaneous mass transfer

Jie Huang[1], Takayuki Saito[2]

[1]*Graduate School of Engineering, Shizuoka University, Japan*

[2]*Research Institute of Green Science and Technology, Shizuoka University, Japan*

Bubbles in a liquid phase are encountered in many industrial and natural processes. The mass transfer from bubbles to the surrounding liquid determines the flow structures and the efficiency of the processes. In order to improve the efficiency of GLAD system (a gas lift system for CO_2 sequestration at Deep Ocean) and to precisely comprehend the complex mechanism of global warming, a thorough understanding of the mass transfer mechanism from a bubble to the surrounding liquid is essential. Liquid phases in industrial applications are usually contaminated by surfactants, sub-μm particles and so on. Therefore, the influences of gas-liquid interface contamination on bubble and wake dynamics and mass transfer across the interface should be elucidated. Here we investigated a single CO_2 bubble (2.9 mm in equivalent dia.) that ascended in a zigzag motion in purified water and in water contaminated with a very small amount of 1-pentanol. We used a laser-induced fluorescence (LIF) technique and a pH-sensitive dye HPTS (8-hydroxypyrene-1, 3, 6-trisulfonic acid) to visualize the bubble-to-liquid-phase mass transfer and the bubble's wake structure. In this study, two high-speed cameras were used to capture the CO_2 dissolution process from the bubble to the surrounding liquid, the bubble motion, and the bubble wake from two orthogonal directions. Based on the visualization results, we obtained the volume, surface area, velocity, orientation angle and shape of the bubble from moment to moment through a new image processing method [1] both in purified water and contaminated water. From the above results, we calculated the instantaneous mass transfer of the bubble [2]. On the basis of these experimental results, we discuss the influences of the bubble-surface contamination on the bubble motion and the mass transfer, as well as the bubble wake.

Keywords: *CO_2 bubble, Zigzag motion, Marangoni effect, Mass transfer, Horseshoe-like vortices*

Reference

[1] T. Saito, M. Toriu, 2015. Effects of a bubble and the surrounding liquid motions on the instantaneous mass transfer across the gas–liquid interface, Chem. Eng. J., 265, 164-175.

[2] J. Huang, T. Saito, 2015. Influence of bubble-surface contamination on instantaneous mass transfer, Chem. Eng. Technol., 38, No. 11, 1947-1954.

Time Frequency Representation of Audio Signal with 2T-EMD based Hilbert Spectrum

Kazi Mahmudul Hassan and Md. Ekramul Hamid

Department of Computer Science and Engineering, University of Rajshahi, Rajshahi 6205, Bangladesh

Time-Frequency representation is an important aspect to analyze nonstationary signals like audio signal. Hilbert Spectrum is a popular way to represent the nonstationary signal in time-frequency-energy distribution, which has several advantages than other methods like Short-Time Fourier Transform, Wavelet Transform etc. Hilbert-Huang Transform is a prominent method to analyze nonstationary signal which consists of Empirical Mode Decomposition (EMD) method and Hilbert Spectral Analysis. A novel analyzing method which is an enhancement of EMD algorithm called Turning Tangent empirical mode decomposition (2T-EMD) is used in this study. The 2T-EMD, which differs from other approaches of EMD for its simplicity and computational lightness, has been developed to overcome some limitation of traditional EMD like cubic spline problems, sifting stopping condition etc. However, 2T-EMD based hilbert spectrum of audio signal encountered some issues due to the generation of too many IMFs in the process. In this work, we have proposed a technique that is actually a combination of classical EMD and 2T-EMD with some filtering, which enhances the Hilbert spectrum representation of audio signal. We first select some IMFs from 2T-EMD and the rest are selected from traditional EMD method. Then we use Savitzky-Golay smoothing filter on each IMF which removes noise as well as solve mode mixing problem to some extent. The number of IMFs that we have selected from 2T-EMD method is decided on the basis of the filter bank property of the analyzing IMFs both in the energy and frequency domain. This refinement of Hilbert Spectrum not only contributes to the future work of source separation problem but also many other applications in audio signal processing.

Keywords: *time frequency representation, hilbert spectrum, 2T-EMD, filter bank*

Investigation of a relationship between components of dissolved gases and shapes of ultrasonic particle flocculation in water

Sayuri Yanai[1], Koji Nomata[2], Hiroya Muramatsu[3], Yuki Mizushima[3], Takayuki Saito[4]

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[3]*Graduate School of Science and Technology, Shizuoka University, Japan*

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In the conventional study, particle concentration forming stripes under MHz-band ultrasonic irradiation have been investigated and reported by many previous researchers. This technique is applied to the μm-order particle operation with the advantages of noncontact and noninvasive in water. To excess the size-limitation of this technique, we developed the new ultrasonic particle concentration technique. By irradiating kHz-band ultrasound in water, dispersed mm-order particles are flocculated forming spherical. This is principally impossible to be formed by the conventional technique because of the short wavelength of MHz ultrasound. This flocculation is caused by Acoustic Cavitation-Oriented bubble (ACOB) adhering to the particle surface. In general, the ACOBs receive the acoustic radiation forces: Primary and Secondary Bjerknes force in ultrasonic field. When ACOBs at the particle surface receive the forces, the particles with the ACOBs move to the high pressure region and form the particle flocculation in water. Recent study, we find out that there are two flocculation patterns: spherical and chain-like one, their patterns are changed depending on the components of dissolved gassed in water. With dissolved air gas, the pattern is spherical and the flocculation diameter is about 8 mm. On the other hand, with dissolved CO_2 gas, the pattern is chain-like and the flocculation is formed by 2-7 particles. The difference of the patterns is caused by the difference of the air and CO_2 bubble motions. In this study, we introduce the relationship between the patterns of the particle flocculation and the components of dissolved gasses from the results of visualization and the acoustic pressure profile in water.

Keywords: *Ultrasound, Particle Flocculation, Dissolved gas, Acoustic Cavitation-Oriented Bubble (ACOB)*

EFFECTS OF HEAT TREATMENT ON THE MICROSTRUCTURE AND PROPERTIES OF $Al_xCrFeMo_ySiTi$ HEA BY HIGH ENERGY BALL MILLING

Balaguru. R[1] , Sheela Singh[2]

[1,2]*SRM University, Chennai , India*

The multi-component alloy $Al_xFeCrMo_ySiTi$ with three compositions (x=1, y=1 ; x=1.5, y=0.5 ; x=1.75,y=0.25) were synthesized using high energy ball milling. The comparison is drawn between these HEAs for as milled and heat treated samples. Preliminary studies on phase, microstructure and composition were done using X ray diffraction (XRD), Scanning Electron Microscope (SEM), Energy Dispersive Spectroscopy (EDX) respectively. The thermal studies of these alloys were performed using Differential Scanning Calorimeter (DSC). The hardness of these alloys was measured using Vickers hardness tester with 0.1N for 15sec and was found to be more than 1100HV. The alloy is intended for high temperature and tribological application where corrosion and wear are pronounced in the working environment.

Keywords : High Entropy Alloy, Crystal Structure, Differential Scanning Calorimeter

Photosensitized oxidation damage of protein and amino acids by phosphorus(V)porphyrins and their binding states

Dongyan Ouyang[1], Shigetoshi Okazaki[2], Kazutaka Hirakawa[1]

[1] *Department of Optoelectronics and Nanostructure Science, Graduate School of Science and Technology, Shizuoka University, Hamamatsu, 432-8561, Japan*

[2] *Medical Photonics Research Center, Hamamatsu University School of Medicine, Hamamatsu City, 431-3192, Japan*

The most well-known cancer treatments may be operation, radiotherapy, and chemotherapy. However, these methods have extremely harmful side effect to human body. Recently, photodynamic therapy (PDT), as a rather new treatment of cancers bacterial diseases, has been researched. Compared to the above methods, PDT has minimal side effects, it is less invasive, and the treatment is outpatient. PDT is a form of phototherapy using nontoxic light-sensitive compounds that are exposed selectively to light, whereupon they become toxic to targeted malignant and other diseased cells. Porphyrins can be used as photosensitizers for PDT, which can cause the photosensitized oxidative damage to biomolecules during visible light irradiation. Singlet oxygen ($^1O_2$) generation has been considered as the main mechanism of PDT; however, low oxygen concentration in cells suppresses this effect. Thus, it is considered that biomacromolecule oxidation through electron transfer (ET) mechanism may play a more important role in PDT [1]. The aim of this study is the evaluation of the ET mechanism to the photosensitized damage of protein and amino acids by novel types of P(V)porphyrins.

The extent of photodecomposition of the amino acids and protein, human serum albumin (HSA), has been elucidated by spectroscopic techniques. The photo oxidized products of amino acids by P(V)porphyrins were also analyzed with fluorescence spectrophotometer, NMR, and LCMS. The results of these experiments suggested the electron transfer-mediated photodamage of amino acids. To evaluate the photosensitized protein damage in detail, the distance between porphyrin and the typical amino acid residues of HSA (r) was estimated from this fluorescence quenching under an assumption that the fluorescence quenching can be explained by the Förster resonance energy transfer. The results of the calculations suggest that the distant between the binding P(V)TPP and the amino acids residues are 6.2 nm (tryptophan) and 5.9 nm (tyrosine). (Fig.1) It is considered that P(V) porphyrins bind to the surface of HSA. These results suggest that relative long-range ET contributes to protein damage photosensitized by P(V)porphyrins.

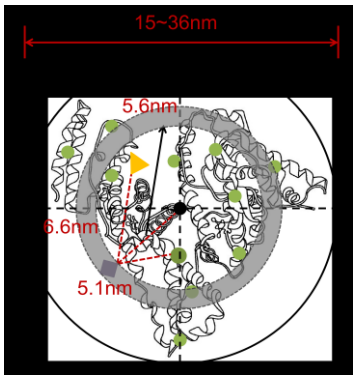

Fig.1 The speculated binding state of P(V)porphyrin with HSA.

Keywords: *phosphorus(V)porphyrins, protein, amino acids, oxidation, binding states*

[1] D. Ouyang, and K. Hirakawa (2015) *Rapid Commun. Photosci.* **2,** 41-44.

Effect of defect formation conditions on deuterium retention behavior in silicon carbide

K. Yuyama[1], Y. Uemura[1], S. Sakurada[1], H. Fujita[1], C. Hu[1], T. Chikada[1], Y. Oya[1]

[1]*Graduate School of Science, Shizuoka University, Japan*

Silicon carbide (SiC) is considered to be used for blanket modules for high temperature gas–cooling system in D-T fusion reactors, as SiC/SiC composites which is consisted of SiC matrix reinforced by SiC fibers. During the plasma operation, SiC would be exposed to energetic particles such as hydrogen isotopes and neutrons from D-T plasma, and gamma ray by transmuted materials, which would induce irradiation defects by electron excitation process, leading to the hydrogen isotope retention enhancement. Tritium inventory in ITER (international thermonuclear experimental reactor) is limited to be less than 1 kg per day. Therefore, it is important to evaluate the hydrogen isotope retention in SiC damaged by various defect formation conditions. In this research, deuterium (D) retention in 2.8 MeV Fe^{2+} and gamma ray irradiated SiC were studied with thermal desorption spectroscopy (TDS) method. In addition, XPS (X-ray photoelectron spectroscopy) measurement for SiC before/after D_2^+ implantation were performed to elucidate the hydrogen isotopes desorption mechanisms. Disk type β−SiC (10 mm in diameter and ~ 0.5 mm in thickness) supplied from Asahi Glass Co., Ltd. was used as a sample. After annealing at 1173 K as a pretreatment, Fe^{2+} implantation with a damage concentration of 1 dpa (displacement per atom) and gamma ray irradiation with a dose of 400 kGy were conducted. Thereafter, 1 keV D_2^+ was implanted for the samples with a fluence of 1.0×10^{22} D^+ m^{-2} at room temperature. The TDS measurement was applied from room temperature to 1273 K with a heating rate of 0.5 K s^{-1}. For all samples, D_2 desorption was divided into two peaks located at 890 K and 1080 K, attributing to be the desorption of D bound to Si to be Si-D bond and that bound to C to be C-D bond, respectively[1]. For Fe^{2+} implanted SiC, the retentions of D as both Peak 1 and Peak 2 were increased, which suggested that dangling bonds derived by Fe^{2+} implantation enhanced the D retention. In this presentation, D retention behavior in gamma ray irradiated SiC will be also shown and detail mechanism of D trapping by damage introduction into SiC will be discussed.

[1] Y. Oya, Y. Ohnishi, et al., Mater. Trans., 46- 3, (2005) 552.

Keywords: *Hydrogen isotope retention, Silicon carbide, Thermal desorption spectroscopy, X-ray photoelectron Spectroscopy, Fusion*

Effects of indirect action by Gamma-rays to survival rate in Tardigrades

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The tardigrades belong to a group which have a close relationship to an arthropoda and are aquatic animal with a length of 1mm or less. Many tardigrades live in terrestrial mosses and lichens. The bodies of tardigrades are short, plump, and ventrally there are four pairs of stubby legs which have four to eight claws each.Tardigrades are with remarkable abilities to withstand harsh physical conditions such as dehydration or exposure to harmful energetic radiation. An animal in such a condition is called a tun.

When the mosses become desiccated, the tardigrades are contracted and shriveled, and finally they will be in condition of anabiotic state. However the tardigrades are reactivated by the existence of water Tardigrades recover after immersion from tun.

In this study, effects of indirect action by Gamma-rays to survival rate in tardigrades.

Tardigrades withstand 4000Gy Gamma-rays in tun. This result suggests that tardigrades have a great ability to withstand radiation than other organism.But aquatic tardigrades have higher radiation tolerance. I investigated the effects of indirect action by Gamma-rays to survival rate in Tardigrades(*Milnesium tardigradum*). I found that aquatic tardigrades withstand 6500Gy Gamma-rays and be affected by indirect action. However I do not understand detailed mechanism for radiation tolerance in Tardigrades.

Therefore I divide it into five classes every size and irradiate aquatic tardigrades 5000Gy,2228Gy,1250Gy, 800Gy,556Gy at the same time by Gamma-rays from relations of distance and time. Survival rate in Tardigrades is data logging. Discrimination of life and death is five classes of optionally made table.

In this report show it from more detailed data for effects of indirect action by Gamma-rays to survival rate and have ability for high recovery from radiation exposure in Tardigrades.(313 words)

Keywords: Tardigrades,Radiation Tolerance ,Indirect action

Effects of thermal annealing under/after heavy-ion irradiation on deuterium retention in W

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Introduction of displacement damages by neutron irradiation leads to the enhancement of hydrogen isotope retention in tungsten (W) as plasma facing materials (PFMs), which may be a key issue for fusion safety and fuel efficiency. In addition, it is well known that the behavior of irradiation defects is largely influenced by the temperature, which leads to their recovery and/or aggregation and the enhancement or reduction of hydrogen isotopes retention. For the precise evaluation of tritium retention behavior in W, a systematic study as a function of annealing temperature for damaged W is important.

The W samples were irradiated by 6 MeV Fe^{2+} with irradiation damages of 0.1 dpa at room temperature or 6.4 MeV Fe^{3+} with the same damage concentration at 573-1173 K. These samples were annealed at 573-1173 K for 30 minutes. Thereafter, 1 keV D_2^+ irradiation with a fluence of 1.0×10^{22} D^+ m^{-2} and thermal desorption spectroscopy (TDS) were performed to evaluate the D retention behavior. In addition, positron annihilation spectroscopy (PAS) measurement and transmission electron microscopy (TEM) were also applied to study the recovery/aggregation behavior of the defects.

The D_2 TDS spectra as a function of annealing temperature showed that the D retention was clearly reduced as the annealing temperature was increased. In particular, the desorption of D trapped by voids was largely reduced by annealing at 1173 K. In addition, hydrogen retention in the sample irradiated at higher temperature was clearly smaller than it in the sample annealed at the same temperature. PAS experiment showed that void concentration was decreased and its size got smaller compared with that for the annealed sample, which agreed with TDS results. So, these results suggest that the recovery of the defects is enhanced under irradiation at higher temperature compared with that annealed after irradiation.

Keywords: *Thermal annealing behavior, Tungsten, Hydrogen isotopes retention, Fusion*

Effect of viruses on the evolution of bacteria

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Viruses are highly abundant in the sea, with a concentration of approximately 10^7/mL of seawater and about 10 times larger than the number of marine bacteria. Every second, viruses bombard marine bacteria and may infect them. Once a virus finds suitable bacterial hosts, it will inject its genetic material into the host and incorporate it into the host's DNA. There are two types of viral life-cycles depending on the virus type and living conditions: (i) lytic, which virus kills the host and release its progenies immediately, and (ii) lysogenic, which virus hides in the host's genome for later attack. In the latter case, a virus does not have an immediate mortality effect on the host bacterium, but since the viral DNA is being replicated together with the bacterial DNA when the bacterium divides, the hidden virus causes changes in genome between bacterial populations. These changes may affect the bacterial physiology and may drive the evolution of bacterial populations.

To study how viruses can confer survival advantage to bacteria in marine environment, our research group induced a virus that was hidden in an environmental bacterial strain lived in the marine sediment and transferred this virus to another fecal strain collected from pig feces. This process created an isogenic lysogen, which is a strain different from the original fecal strain by harboring one more virus in its genome. These three bacteria strains form a model for demonstrating the possible ways of how viruses can affect bacterial physiology. Growth and survivorship of the three strains under different laboratory conditions were investigated. Results showed that the lysogen has better survivorship in marine environment compared to the fecal strain, suggesting that the newly obtained virus can confer fitness to its host. Further investigations showed that carbon metabolism of the lysogen was different from the fecal strain. This study provides new insights on how viruses affect marine bacteria lifestyle and evolution.

Helium fluence dependence on deuterium gas permeation behavior in tungsten

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Tungsten (W) is considered as one of plasma facing materials (PFMs) for fusion reactors. However, during plasma operation, irradiation damages will be introduced in the PFMs by the exposure of various energetic particles, such as helium (He), hydrogen isotopes and neutron from plasma. In particular, He bubble was formed in W by He^+ irradiation, which works as a diffusion barrier, and was not completely recovered as the sample temperature was reached at 1173 K [1]. Therefore, the evaluation of hydrogen isotope permeation behavior with consideration for He bubbles is quite important to understand the fuel behaviors for the fusion reactor operation.

In this study, 3.0 keV He^+ irradiation was performed with fluence range of 0.03-9.0×10^{21} He^+ m^{-2}. Thereafter, the gas-driven D permeation behaviors for He^+ irradiated W were studied, and the He^+ fluence dependence on the hydrogen permeation behavior was discussed.

The D permeability was reduced with increasing He^+ fluence; however no large difference of the D permeability was found for W with the fluence of 3.0 and 9.0×10^{21} He^+ m^{-2}. By heating at 1173 K, the D permeability for all samples at 873 K was clearly increased but did not agree with that for un-damaged W. Transmission electron microscope (TEM) observation for W with the fluence of 3.0 and 9.0×10^{21} He^+ m^{-2} showed that the density of dislocation loops was higher as the fluence was increased to about twice. He bubble was grown in size as the fluence was increased, and their shape was changed into a polygon form by higher fluence. It was indicated that no large difference in the D permeability was found in He^+ fluence range of 3.0-9.0×10^{21} He^+ m^{-2} by competition with the formation of defects and He bubbles. In addition, the D permeability at 873 K by heating at 1173 K for W with higher He^+ irradiation was still remained lower due to the existence of He bubbles and reduction of D diffusion path.

[1] M. Sato, K. Yuyama, X. Li et al., Fusion Sci. Technol., In press

Keywords: *Hydrogen isotope permeation, Helium irradiated W, Tungsten, Fusion*

Dependence of irradiation defect distribution on deuterium retention behavior in damaged tungsten

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Tungsten (W) is the most promising candidate for the plasma facing material in D-T fusion reactors due to its lower erosion yield and higher melting temperature. During the plasma operation, W would be exposed to 14 MeV neutrons produced by the D-T fusion reaction, and irradiation defects would be introduced in W by the neutrons. Then hydrogen isotopes would be stably trapped by the irradiation defects, leading to the enhancement of the fuel retention. For the development of effective fuel recycling and the safety of fusion reactors operation, it is necessary to clarify the hydrogen isotopes retention behavior in neutron-irradiated W. However, most of the previous experiments have been done using heavy-ion-irradiated W to simulate hydrogen isotope retention behavior in neutron-irradiated W due to the limitation of handling for neutron-irradiated materials. The defect distribution for heavy-ion-irradiated W is concentrated in the shallow region near the surface, while that for neutron irradiation will be formed uniformly throughout the bulk [1]. Therefore, it is expected that the hydrogen isotope behavior in neutron-irradiated W would be different from that in heavy-ion-irradiated W. To understand the initial process of defects formation in neutron-irradiated W, the hydrogen isotope retention behavior in neutron-irradiated W with a low displacement per atom (dpa) was evaluated. In this study, the irradiation defects were introduced by Fe^{2+} irradiation, neutron irradiation from fission reactions (> 0.50 MeV) and 14 MeV neutron irradiation from D-T fusion reaction. After the irradiation, the 1 keV deuterium ion (D_2^+) implantation was performed, and the D retention behavior was evaluated by thermal desorption spectroscopy (TDS). In addition, the simulation integrating diffusion and trapping/detrapping in material was also applied to reveal the D trapping states in the damaged W. From the experimental results, dense vacancies and voids within the shallow region near the surface were introduced by Fe^{2+} irradiation, and the trapping state of D by vacancies and voids were clearly controlled by the damage concentration. It was concluded that the voids would be the most stable D trapping site. For 14 MeV neutron irradiation, it is indicated that stable trapping sites would be formed into W with lower neutron fluence. On the other hand, for fission neutron irradiation, only low energy trapping sites would be formed, or the rhenium (Re) produced from transmutation of the W by the thermal neutron irradiation may have enhanced the D re-emission from the vacancies produced. (395 words)

[1] Y. Hatano, Y. Oya, M. Hara, et al., J. Plasma Fusion Res. 89, 725 (2013)

Keywords: plasma facing materials, tungsten, neutron irradiation, hydrogen isotope retention

Effect of carbon implantation on deuterium retention behavior for damaged tungsten

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Tungsten (W) is a candidate for the plasma facing materials in D-T fusion reactors like ITER due to its higher melting point and lower sputtering yield. During plasma operation, W will be exposed to energetic particles, including neutron, hydrogen isotopes, and impurities like carbon (C). It is well known that irradiation defects were introduced by energetic particles, where hydrogen isotopes were trapped. In addition, C-W mixed layer was formed by C^+ implantation for W, which suppressed the deuterium (D) diffusion [1-2]. Therefore, it is important to elucidate C^+ implantation effect on D retention behavior for damaged W to comprehend hydrogen isotope dynamics in actual reactor conditions.

In this study, the irradiation defects were introduced by 6 MeV Fe^{2+} implantation with the damage concentration of 0.01, 0.1 and 1.0 dpa (displacement per atom) to simulate neutron irradiation. The 10 keV C^+ implantation was performed with the flux of 1.0×10^{17} C^+ m^{-2} s^{-1} up to the ion fluence of 1.0×10^{21} C^+ m^{-2}. Thereafter, 3 keV D_2^+ was implanted with the ion flux of 1.0×10^{18} D^+ m^{-2} s^{-1} up to the ion fluence of 1.0×10^{22} D^+ m^{-2}. Finally, thermal desorption spectroscopy (TDS) measurement was performed from room temperature to 1173 K to evaluate the D retention behavior for damaged W samples. The results showed that the retention of D trapped by voids was increased as the damage concentration was increased. On the other hand, no remarkable enhancement of D trapped by vacancies was found in spite of damage accumulation, indicating that the vacancies formed by Fe^{2+} implantation would trap C, which refrained D trapping by vacancies. The voids can sufficiently trap D, as the size of void is larger than that of vacancy. (289 words)

[1] T. Shimada *et al*., *J. Nucl. Mater.* 313 (2003) 204.

[2] V.Kh. Alimov *et al., J. Nucl. Mater.* 282 (2000) 125-130.

[3] Y. Oya, X. Li, M. Sato *et al., J. Nucl. Mater.* 461 (2015) 336-340.

Keywords: *deuterium retention, C^+ implantation, tungsten, fusion reactor*

Influence of mixed material layer formation on hydrogen isotope retention in W exposed to 2014 LHD experiment campaign

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Tungsten (W), which possess higher energy threshold for sputtering, low ability to hydride formation and low hydrogen solubility level, has been selected as the most likely candidate of plasma facing materials (PFMs) for future fusion reactors. For study the hydrogen isotope retention behavior in W exposed in plasma, the W specimens were placed in the four positions of the plasma facing wall, namely PI (typical PWI area), DP (deposition dominated area), HL (higher heat load area) and ER (erosion dominated area) in the Large Helical Device (LHD) at NIFS and were exposed to long term hydrogen plasma in the LHD experimental campaign. The deuterium retention behavior of the H plasma exposed W for the different LHD experiment campaign was systemically investigated. Our previous works showed that the thickness of carbon-dominated mixed-material layer (with impurities of oxygen and Nitrogen, etc.) deposited on the W has increased year by year because of the usage of graphite instruments and the enhancement of the plasma performance. Additional deuterium implantation and thermal desorption spectroscopy (TDS) experiment result proved that the hydrogen isotope will be accumulated in this carbon-dominated mixed-material layer. In addition, the helium (He) desorption behavior has been observed for 2013 experiment campaign due to long-term He plasma discharge was performed to achieve high plasma performance. As the development of the system and the improvement of the plasma performance, the composition and microstructure of the surface impurity layer will be changed. So, we will continue to investigate the deuterium retention behavior for tungsten which was exposed in LHD during the latest (2014) experimental campaign in present work. Microstructure and chemical state of the specimens were analyzed by SEM, TEM and XPS. Additional deuterium implantation was performed for these specimens and their deuterium retention behavior was estimated by TDS. Results showed that a carbon-dominated mixed-material layer was formed on the all of the specimens except for ER sample. The thickness of impurity layer has increased as compared with that of 17^{th} experimental campaign. A large amount of H_2 and He was trapped in this mixed-material layer.

Keywords: LHD, Tungsten, Deuterium retention, TDS

Study on self-healing of ceramic coatings for hydrogen isotope permeation barrier

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Hydrogen isotopes are promising candidates for a source of advanced energy systems, e.g. nuclear fusion power plants and fuel cells. However, a strict control is required for safety because hydrogen is an explosive gas, and tritium is a radioactive isotope. Moreover, they diffuse fast into structural materials at elevated temperature. Therefore, the evaluation of hydrogen isotope permeation behavior is important to ensure an efficient fuel cycle and safety operation. Ceramic coatings have been investigated to reduce hydrogen permeation through structural materials. Yttrium oxide have been investigated as a hydrogen permeation barrier material due to its high permeation reduction factor and low radioactivation property. One of critical issues for hydrogen permeation barrier is the degradation of surface coverage, which is caused by crack formation. Even if a small crack is introduced, hydrogen permeation is drastically increased. Therefore, to develop self-healing coating technique, oxidation experiments were performed to select self-healing materials followed by the fabrication of yttrium oxide coatings with and without the self-healing material.

Carbide powders utilized as self-healing materials were oxidized at 773-973 K in air, and their crystal structures were analyzed using X-ray diffraction (XRD). After the oxidation experiment, yttrium oxide coatings with the self-healing material were fabricated by metal organic decomposition using a commercially available precursor and carbide nanoparticles. Reduced activation ferritic/martensitic steel plate substrates (Fe-8Cr-2W) were dipped into the precursor with and without the carbide nanoparticle, withdrawn at a constant speed of 1.0 mm s^{-1} using a dip coater, dried at 423 K for 7-10 min, and pre-heated at 823 K for 2 min on hot plates. This process was repeated for three times. Thereafter, a heat-treatment was performed at 973 K for 1 h under high-purity argon atmosphere for the crystallization of the coatings. Elemental analysis of the coatings was performed using X-ray photoelectron spectroscopy. Deuterium permeation measurements were performed using a gas-driven deuterium permeation apparatus. The effect on the deuterium permeation was investigated by comparing the permeation behavior for the yttrium oxide coating samples with and without the carbide nanoparticle.

XRD patterns of the heat-treated powders showed that chromium carbide was oxidized to chromium oxide at above 876 K. It is expected that chromium carbide shows self-healing behavior due to the oxidation in the proper temperature range. In the presentation, deuterium permeation behaviors of the coatings will be investigated, and the effect of chromium carbide nanoparticle on the permeation behavior will be discussed. (397 words)

Keywords: hydrogen, tritium, permeation, ceramic coating, self-healing

Development of ceramic-metal multilayer coatings for fusion reactor fuel systems

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The development of fusion reactors has been advanced as a promising power generation system. Fusion reactors produce energy by a nuclear fusion reaction of deuterium and tritium, which are hydrogen isotopes. Hydrogen atoms permeate through metal structural materials, leading to a crucial fuel loss and radiological hazard especially in the case of tritium. Moreover, structural materials would be corroded by tritium breeding materials such as liquid Li-Pb. For the establishment of fusion reactors, the development of tritium permeation barrier with corrosion resistance property is required. To overcome these problems, application of ceramic-metal multilayer coatings on structural materials is promising. Ceramic coatings can provide permeation reduction factors (PRFs) of more than 10^3 and metal coatings which is compatible with liquid Li-Pb. Multi-layer coatings have been recently studied and shown an enhancement of RPF; however, precise hydrogen permeation behavior has not been clarified yet [1,2]. For further improvement of fuel loss and safety, hydrogen permeation mechanism in multi-layer coatings should be elucidated.

In this study, 1-3 μm-thick erbium oxide (Er_2O_3) coatings were fabricated by filtered arc deposition on reduced activation ferritic/martensitic steels F82H, which showed an excellent permeation reduction performance. Iron (Fe) was applied as a metal layer to protect from corrosion, which was fabricated by radio-frequency magnetron sputtering (0.26-0.65 μm) or covered with an iron foil (10-20 μm) on the single layer Er_2O_3 coating. An Er_2O_3-Fe-Er_2O_3 three-layer coating was also fabricated. Then deuterium gas-driven permeation experiments were carried out at the temperature range of 773-973 K. In addition, depth profiles of deuterium concentration in the coatings were evaluated for Er_2O_3-Fe and Er_2O_3-Fe-Er_2O_3 coatings by nuclear reaction analysis.

Comparing with the permeation experiment results for various Er_2O_3-Fe coating samples, a similar pressure dependence and permeability were found. No large difference in the activation energy of permeability was confirmed, indicating that deuterium permeation in Er_2O_3-Fe was not controlled by the thickness of Fe, but by diffusion in Er_2O_3. For the Er_2O_3-Fe-Er_2O_3 coatings, PRFs were increased up to 10^4 due to two diffusion barriers of Er_2O_3. However, the PRF was less than the sample coated on both sides of the substrate, possibly derived from a recombination process on the back surface [3]. Moreover, each layer of Er_2O_3-Fe-Er_2O_3 coating had higher D concentration than the Er_2O_3-Fe coating. Three-layer coating showed high PRFs, while tritium inventory should be carefully considered. (384 words)

[1] T. Chikada, A. Suzuki, F. Koch *et al., J. Nucl. Mater.* 442 (2013) 592-596.

[2] T. Chikada, A. Suzuki, T. Terai *et al., F. Engi. Design.* 88 (2013) 640-643.

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Keywords: *Fusion reactor, Tritium*, *Permeation, Ceramic coating*

Antimicrobial peptide Lactoferricin B-induced permeation of fluorescent probes in single giant Unilamellar vesicles

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It is well known that antimicrobial peptide, bovine lactoferricin B (Lfcin B) produced by enzymatic digestion of lactoferrin has a strong bactericidal activity, but its mechanism is unknown. To elucidate the mechanistic basis of Lfcin B bactericidal activity, we investigated the interaction of Lfcin B with *Escherichia coli* and liposomes of lipid membranes [1]. Lfcin B induced the influx of a membrane-impermeant fluorescent probe, SYTOX green, from the outside of *E.coli* into its cytoplasm. Lfcin B induced gradual leakage of calcein from large unilamellar vesicles (LUVs) of dioleoylphosphatidylglycerol (DOPG)/dioleoylphosphatidylcholine (DOPC) membranes. To elucidate the cause of Lfcin B-induced leakage of calcein from the LUVs, we used the single giant unilamellar vesicle (GUV) method to investigate the interaction of Lfcin B with calcein-containing DOPG/DOPC-GUVs. We observed that a rapid leakage of calcein from a GUV started stochastically, and it statistical analysis provided a rate constant for Lfcin B-induced pore formation, k_p. On the other hand, phase contrast microscopic images revealed that Lfcin B induced a rapid leakage of sucrose from the single GUVs with concomitant appearance of a spherical GUV of smaller diameter. Here we used the word of "local rupture" to express the rapid leakage of sucrose and determined the rate constant of local rupture, k_L. Based on the comparison between k_p and k_L, we concluded that the leakage of calcein from single GUVs occurred as a result of a local rupture in the GUVs. The results of the effect of the surface charge density of lipid membranes and that of salt concentration in buffer on k_p clearly show that k_p increases with an increase in the extent of electrostatic interactions due to the surface charges. Analysis of Lfcin B-induced shape changes indicated that the binding of Lfcin B increased the area of the outer monolayer of GUVs. These results indicate that Lfcin B-induced damage of the plasma membrane of *E. coli* with its concomitant rapid leakage of internal contents is a key factor for the bactericidal activity of Lfcin B.

Keywords: *Lactoferricin B, Giant unilamillar vesicles, Rate constant, Sytox green.*

References: [1] *Biochemistry*, 2015, *54* (38), pp 5802–5814

Effect of water stress on growth and yield quality of Khao Dawk Mali 105 and Hawm Suphan Buri 1

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Abstract

Drought is considered to be a serious factor limiting rice production and quality. The present study is to examine the growth and yield of two aromatic rice varieties under different levels of drought stress. A pot experiment was undertaken in factorial in CRD with 9 replications. The study factors were 1) rice varieties, namely Khao Dawk Mali 105 (KDML105) and Hawm Suphan Buri (SU), and 2) different levels of water supply, corresponding to 100% (normal condition or control), 50%, 25%, 12.5% and 0% (drought stress condition). Rice seedlings were transplanted in plastic pots and watered at 5 different water rates for 10 days at the seeding stage and tillering stage. The result showed that the effect of drought stress on tiller number per plant and root length did not lead to significant differences, whereas a significant decrease in the root dry weight of both rice varieties under 12.5% and 0% water supply was observed comparing to the control. The panicle number per plant significantly decreased from 12.5% water treatment, whereas the grain number per panicle was significantly decreased from 50% water supply, comparing to the control, which may account for the a significant decrease in the grain yield under a decrease of water supply from 50%. In addition, the yield of both rice varieties slightly decreased with the decrease of water supply. However, the SU variety showed less reduction in the grain weight per panicle and 1,000-gain weight than KDML105, while the undeveloped grains per panicle of KDML105 remarkable increased comparing to that of the SU variety under drought stress. It was, therefore, concluded that the SU variety may have a greater drought tolerance than the KDML105 variety.

Keywords: Aromatic rice; drought tolerance; grain yield; yield component

PERFORMANCE EVALUATION OF ADVANCE BLAST RESISTANT RICE LINES IN SEBERANG PRAI, PULAU PINANG

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Rice (*Oryza Sativa*) is the most valuable and primary food crop for more than 50% of the world population. Inadequate in rice production in Malaysia is affected by the blast disease as this disease is the most harmful treat to the high productivity in rice. One of the approaches used towards further improvement of disease resistant and yield was the introduction of genes from exotic sources which consisted resistant genes into the plant of interest that consisted high yield character. In this study, MR 219 rice variety and thirteen advance rice lines from the crosses between MR 219 as a recurrent parent and Pongsu Seribu 1 as a donor parent from the previous study was used to evaluate their performance in Seberang Prai, Pulau Pinang. From the evaluations, the range for the days to heading were 65 days (P-4-7-42) and 83 days (P-4-1-70), the highest percentage for the effective tillers was 92 % which shown by lines P-4-1-37, P-4-1-50, P-4-1-1 and P-4-7-42. Lines P-4-1-37 shows the highest 1000 weight grain which was 28.27 g while P-4-1-14 has the highest yield per plant that is 64.15 g. The disease scoring for the lines was based on the IRRI Standard evaluation. All the 13 advance lines resistant compared to MR 219.

Keywords: Blast, Advance rice lines, yield attribute

Efficacy of High Quality Organic-Fertilizer on Growth and Yield of Purple Riceberry in Different Soil Series

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Abstract

The objective of this research was to compare the effect of high quality organic fertilizer with chemical fertilizer on the growth and yield of Riceberry, purple pigmented rice. A pot experiment was undertaken in a factorial in CRD with nine replications. Factors were two types of soil series: Rungsit (fertile soil) and Ongkharak (infertile soil) and five different fertilizer treatments: no added fertilizer (control), chemical fertilizer (16-20-0 + 46-0-0) at 21.84 kg N / rai and high quality organic-fertilizer at 21.84, 43.68 and 81.40 kg N / rai. The results revealed significant differences between soil series, fertilizer treatments and their interactions on the plant length and panicle number per plant. The plant length, tiller and panicle number per plant increased with the rise of nitrogen. For the yield components, the grain number per panicle, percentage filled grains per panicle and grain yield per plant increased slightly, whereas the undeveloped grains per panicle decreased with the increase of organic fertilizer. In fertile soil, the percentage filled grain per panicle did not significantly with the fertilizer treatments. However, in the infertile soil, the percentage filled grain per panicle of Riceberry was clearly different between the control and fertilizer treatments. Although the grain yield per plant of Riceberry under the high quality organic fertilizer treatment was lower than that under the chemical fertilizer treatment at the same N level, the 43.68 and 81.40 kg N / rai treatments showed higher grain yield than that of chemical fertilizer at 21.84 kg N / rai. The results suggest that the application of high quality organic fertilizer at 43.68 kg N / rai and above may substitute for the use of chemical fertilizer at 21.84 kg N / rai.

Keywords: High quality organic fertilizer; nitrogen application; pigmented rice;soil conditions; yield component

Inhibitory effect of foodborne bacteria by metabolites from Lactic acid bacteria

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Food spoilage is a main problem in worldwide food industries, which is caused by contamination of some microorganisms. Food preservation involves in preventing growth of microorganisms and extending the shelf life. Bacteriocins are famous as biological compounds in food industries for their antimicrobial action against other bacteria, principally closely related species including foodborne bacteria. Lactic acid bacteria (LAB) are the main bacteriocins producer, which are the intestinal flora and usually found in many kinds of fermented food products. This research aims to screen for LAB with antibacterial metabolites against foodborne bacteria. Three hundreds and sixty-five strains of LAB were isolated from fermented food and cockroaches' intestine and screened for antibacterial activities against five pathogenic bacteria including *Bacillus cereus*, *Staphylococcus aureus*, *Listeria monocytogenes*, *Escherichia coli* and *Salmonella typhimurium* by agar well diffusion method. Unknown LAB strains were identified by using 16S rDNA, the results showed that *Lab279* and *I6S2* showed highest inhibition with broad spectrum of antimicrobial effect. From partial 16S rDNA sequence, both strains were identified as *Lactobacillus plantarum*. Crude culture supernatant of these two strains were prepared using 50% ammonium sulfate precipitation and dialysis (MWCO 3.5 kDa). After dialysis, proteins were determined by SDS-PAGE and proteins lower than 30 kDa had the inhibitory effect to *B. cereus* by in gel activity assay. In addition this study interested in optimizing the condition for encapsulation of bacterial metabolites with chitosan (CS) and sodium tripolyphosphate (TPP) nanoparticles to improve the activities of metabolites. CS/TPP nanoparticles were spontaneous synthesized by the process of ionic gelation based on the interaction between the negative charge from phosphate groups of TPP and the positive charge from amino groups of chitosan and OVA was used as a model protein. CS/TPP mass ratio 5:1 of Taming chitosan oligomer, 3:1 of Taming chitosan polymer and 5:1 of Korea chitosan showed the high encapsulation efficiency (65%, 97% and 85% respectively). These ratios will be applied with crude metabolites of LAB in the future and test for their inhibitory effect to foodborne bacteria.

Keywords: Lactic acid bacteria, Foodborne bacteria, Bacteriocins, Chitosan nanoparticles

GENE EXPRESSION ANALYSIS OF CHALCONE SYNTHASE AND ISOFLAVONE SYNTHASE IN LOCAL BLACK SOYBEAN

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Black soybean used as raw material of soy sauce industry and other local foodstuffs. Development of local black soybean into variety which has high content of isoflavone is needed to expand its utilization as raw material for medicine and functional food. Information on the expression of genes in controlling isoflavone and its correlation with isoflavone content of black soybean is needed for breeding program. This research aimed to study gene expression pattern in biosynthetic pathway of isoflavone especially chalcone synthase and isoflavone synthase and its correlation with isoflavone content of black soybean. Four local black soybean genotypes are grown in locations with altitude of 250 m above sea level. Analysis of gene expression using Real Time PCR and analysis of the levels of isoflavone using HPLC carried out on vegetative and reproductive phase of black soybean. The results showed that the isoflavone content of the leaves and seeds varied among the four genotypes along vegetative to middle reproductive phase (V3-R6) and become increasing at the end of the reproductive phase (R7-R8). The expression of four genes in leaves showed a pattern related to the isoflavone content except IFS1 genes in UP106 that showed decreasing in gene expression. Expression of CHS7 and CHS8 genes in seed showed relatively similar pattern among the four genotypes. While IFS1 and IFS2 genes, showed different pattern among the four genotypes. The correlation between gene expression and isoflavone content in leaves and seed of black soybean require further research.

Keywords: gene expression, chalcone synthase, isoflavone synthase, isoflavone, black soybeans

MOTHER IN ENGLISH AND VIETNAMESE SONGS FROM SYSTEMIC LINGUISTICS PERSPECTIVE

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Song lyrics and rhymes serve as an important part of English teaching curricula in a variety of countries. Of all topics, songs about mother have drawn attraction of listeners and learners as they not only entertain people but also educate them in terms of linguistic knowledge and moral values. Until now, there has not been much research on mother songs under the light of linguistics. These provide me with the motivation to carry out the research "*Mother in English and Vietnamese Songs from Systemic Functional Linguistics Perspective"*. The study is conducted to figure out the similarities and differences in the way of representing mother image in view of systemic linguistic perspective. In other words, the study aims to give readers a brief description and analysis of mother in English and Vietnamese songs. Within the framework of an M.A. thesis, the research cannot cover all aspects of meaning of mother songs in English and Vietnamese; we therefore limit it to a manageable scope: analyzing mother songs in terms of transitivity system, and figures of meanings or stylistic devices in depicting mother image. Two principal methods employed in the study are descriptive and comparative analysis. Through descriptive method, the kind of transitivity process as well as stylistic devices which are mostly used in carving mother image in each language will be illustrated. In fulfilling the focuses of the study, the comparative method is applied to the identification of prominent features of mother songs in English and Vietnamese. The paper also provides conclusions on the images to which mother is compared, and these images are closely associated with cultural and historical factors. Insights gained through this study lend themselves to suggestions for designing exercises based on songs for teaching English as well as linguistic theory.

Key words: *mother, systemic linguistics, stylistic devices, descriptive, comparative*

Implicit Persona Pronoun 'Watashi': A Study on University of Indonesia Japanese Studies Students Taking Japanese 1 Lecture

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According to the writer's experiences as a Japanese Language lecturer at University of Indonesia Faculty of Humanities Japanese Studies, there is a huge tendency among beginner Japanese learners, specifically in this case are the students taking Japanese 1 Lecture at University of Indonesia, to apply Indonesian language grammatical rules to Japanese language grammatical rules, also the other way around. To those beginner learners, implicit subject or topic in a conversation or a text usually becomes a big problem in their learning process. Aside from them having difficulties in identifying the subject or the topic, they often omit it when they have to translate it to Indonesian. Even if they succeeded in identifying the subject or topic, it will appear repetitively, resulting in unnatural sentences and or conversations. This problem, of course, could lead into possibilities of misunderstanding or having non-smooth conversations when speaking in Japanese with Japanese speaking people.

Because the nature of this research is still as an early stage research, it aims to map the characteristic of mistakes which are made by the students in identifying implicit subject or topic when translating Japanese texts to Indonesia respectively. The object of this research is University of Indonesia Japanese Studies' students taking Japanese 1 lecture. Data for this research is taken from *Bunpo* or Japanese Grammar Quiz 1. The finding of this research is that the difficulties which have been experienced by beginner Japanese learners in identifying the subject or the topic are influenced by the rule's differences between Japanese and Indonesian language.

Keywords: *ellipsis, implicit topic, implicit subject, language interference, beginner Japanese learner*

High School Students' Textbooks in Japan: Territorial Controversies

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The purpose of this presentation is to discuss how to teach students territorial controversies. Territorial controversies are common problems around the world. The Ministry of Foreign Affairs of Japan makes an assertion about territorial controversies: The Government of Japan generally defines any issues of territorial sovereignty with other states that need to be resolved as "territorial disputes". The territorial disputes that Japan is involved in are the Northern Territories issue with Russia and the Takeshima issue with the Republic of Korea. There exists no issue of territorial sovereignty to be resolved concerning the Senkaku Islands.

The Senkaku islands dispute and the Takeshima issue are quite serious problems recently and these territorial issues should be taught to students at schools. Textbooks are books that people and students use and they are the main teaching material organized according to the curriculum in the elementary school, the junior high school, the high school and others. They should be authorized the textbook authorization system of the Minister of Education, Culture, Sports, Science and Technology or should be authored by Ministry of Education, Culture, Sports, Science and Technology (MEXT). At these schools, they should be used in each class provided in article 34 of the School Education Act. They play an important part in education as the main teaching material in children's educational activities.

Textbooks are basically written by private companies. They should be based on the government course guidelines and the standards for the Textbook Authorization, also MEXT encourages originality of the textbook companies. Textbooks should be examined whether they are proper as textbooks by the Textbook Authorization Research Council. At the same time, they are investigated by the Senior Specialists for Textbooks of MEXT. The Minister of Education, Culture, Sports, Science and Technology authorizes them according to the specialists' reports.

World history and Japanese history textbooks have no mention of territorial controversies at all. Geography textbooks increasingly refer to territorial controversies. Most of them describe the current situation but the causes and the backgrounds leading to the conflict are not referred to in detail.

The above facts is the current situation of high school students' textbooks in Japan.

Keywords: territorial controversies, the Senkaku Islands dispute, the Takeshima issue, textbooks

Motivation in foreign Language Learning in Mongolia

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The Mongolian National University of Education is a national teacher training institution, which has been carrying a leading role in preparing educators and professionals in the education sector. English is as foreign language teachers often have problems with motivating the students. This article is written for teachers with large classes of students who have encountered some of the following or similar problems during speaking activities in their classroom. We often speak to students in Mongolian to make them more interested in English. We usually try to motivate our students in many different ways. Motivation is one of the main elements directly related to success in developing a second language. It determines the extent of active and personal involvement in language learning at different stages. In Mongolia, studies of how motivation operates in English language learning have been conducted mostly with secondary and tertiary students. Also, motivation is important for our teaching process and for students learning process.

Key word: Motivation, Language learning, Relationships between teachers and students

A Study of Disaster Prevention Education to Develop the Ability to Think

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The Great East Japan Earthquake in 2011 has had a big impact on Japanese school education. Many educational specialists claim that our disaster prevention education needs to be developed. Japanese schools have to review past disaster prevention education and develop it. Our country's disaster prevention education has mainly focused on how to quickly and safely evacuate from classroom with measures such as disaster drills. However, the Great East Japan Earthquake showed that it is important for students to learn making prompt and correct judgments to save their own lives when a disaster occurs. After the Great East Japan Earthquake, Fujii laboratory in Shizuoka University is developing new type of disaster prevention education. It is called "Disaster Moral Education". The purpose of this study is to develop both teaching materials and lesson plans in which moral education and disaster prevention education are linked. People face strong dilemmas between the knowledge of disaster prevention science and moral sentiment in times of disaster. In Disaster Moral Education, teachers provide dilemma for students to consider. Students try to reach the best answer thorough thinking about the dilemma and debating. Teachers take the role of facilitator and help student participation in the debate. More than 20 lesson plans of Disaster Moral Education have been developed and used in more than 30 schools all over Japan. Disaster Moral Education demonstrates actual cases of conflicts in times of disasters, and the teaching materials are based on the date collected and interviews conducted at disaster site. This study introduces one of their lessons called "Do you run for your own safety or do you help loved ones?" conducted at a school in Shizuoka City.

Keywords: Disaster Prevention Education, Moral Education, dilemma, ability to think

Morphological modification of Mg-based silicide films grown by reactive deposition epitaxy

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Recently, semiconducting silicides have attracted much attention for their potential to create new classes of environmentally friendly electronics. Mg_2Si and its related compounds are expected as one of environmentally friendly materials due to their many significant advantages, such as low-cost, natural abundance and non-toxicity. Magnesium silicide (Mg_2Si), having an anti-CaF_2 structure and a lattice constant of 0.6351 nm, was reported as a narrow-band-gap semiconductor with an indirect band gap of 0.6–0.8 eV. In addition, the band gap of the ternary $Mg_2Si_{1-x}Ge_x$ can be controlled by x in $Si_{1-x}Ge_x$ from 0.78 eV (x =0) to 0.69 eV (x =1). The Mg-based compounds were originally considered to be one of thermoelectric materials capable of operating above 200 °C. Moreover, Mg_2Si has been also investigated as infrared photoelectronic materials. Recently, it was shown that Mg_2Si nanoparticle electrode has a good cycle performance with a high initial discharge capacity for application to Li ion battery.

Because of the high diffusion coefficient of Mg in Mg_2Si, the Mg_2Si films with a smooth Mg_2Si/Si (111) interface were successfully grown by the reactive deposition epitaxy, and the structural properties of the Mg_2Si crystals have been investigated. However, it is difficult to control the morphological feature of the Mg_2Si films for the each application. In this study, Mg_2Si and $Mg_2Si_{1-x}Ge_x$ films were grown by the reactive deposition epitaxy with the use of Mg source, and the growth condition dependence of the morphological and structural properties of the films was investigated. In addition, the films were also grown by the reactive deposition technique with the use of $MgCl_2$ source. The structural properties of the Mg-based silicide films were clarified, and their morphological modification will be discussed.

Keywords: environmentally friendly electronics, semiconducting silicide, reactive deposition epitaxy, and morphological evolution.

Novel factors related to biofilm formation in *Escherichia coli*.

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Microorganisms form biofilm, which is composed of cells and extracellular polymeric substances (EPS). Biofilms are seen in many industrial and medical perspectives, and it has been known that EPS significantly affects biofilm formation. *Escherichia coli* biofilm is expected for a novel platform for the immobilization of materials. It is known that one of main components of EPS produced by *E. coli* is amyloid protein, but its production is not fully understood, because of its complexed gene expression and regulation. In this study, we investigated a network of genetic regulation related to EPS production, biofilm formation and amyloid protein production in *E. coli*.

E. coli K12 was used as a model organism in this study to evaluate EPS production and biofilm formation. Amyloid protein is usually produced around and less than 30°C in this strain, and EPS production was compared between 30°C and 37°C. By screening 4101 strains of KEIO deletion mutant collection, 31 and 20 mutants showed altered congo-red binding EPS production at 30°C and 37°C, respectively, and most of related genes were different between those conditions. We also showed 24 and 19 genes to alter congo-red binding EPS production at 30°C and 37°C, respectively, by using 4118 strains of ASKA overexpression clone library. Of 31 mutants altering EPS production at 30°C, we found that seven new genes affected biofilm formation on microtiter plates. To determine if these genes are related to amyloid protein production at the transcriptional level, expressions of *csgA*, which constitutes the major amyloid protein component, and *csgD*, which is a transcriptional regulator required for activation of the *csgBAC* operon, were examined by a quantitative reverse transcription PCR. In the result, a *yjdA* deletion mutant showed decreased expressions of *csgA* and *csgD*, but a *php* deletion mutant was not changed. Additionally, the synthesis of amyloid protein was not observed in both mutants by transmission electron microscopy. These results showed that Php positively regulates biofilm formation and YjdA regulates amyloid protein production at the transcriptional level.

Keywords: *Escherichia coli*, biofilm, amyloid protein

Isolation of nitrifying microorganisms grown on a low concentration of ammonium from the eutrophied brackish lake Sanaru

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A potential of nitrification in the sediment of brackish lake Sanaru was characterized by multidisciplinary methods, analyses of kinetic parameters and molecular techniques. The clone library analyses targeting gene encoding subunit of ammonia oxidizing enzyme (*amoA*) showed the functional diversity. Interestingly, the *amoA* was only detected with specific sets of primers targeting *Archaea* but not *Bacteria*. A specific genotype of *amoA*, which was closely related to *amoA* from uncultured *Archaea,* dominated in the sediment. DGGE and real-time PCR analyses targeting *amoA* showed that nitrifying archaeal community structure were almost stable and the population density was kept at low concentration, suggested that it is a significantly important for maintaining the nitrogen cycle to keep the concentration of NH_4^+ lower. These results suggested that potential of nitrification was extremely stable in the sediment. Down-flow Hanging Sponge (DHS) reactor was constructed with suspension of lake sediment and the medium containing 0.4 mM of NH_4^+ was supplied at the feeding rate of 1 litter day^{-1}. NO_2^- and NO_3^- converted from NH_4^+ was detected mainly at from day 20 to day 60 and from day 65 to day 125, respectively, however, NH_4^+ was detected after day 125. Real-time qPCR analyses targeting archaeal and bacterial *amoA* indicated that the copies number of archaeal *amoA* were almost maintained at 7×10^7 copies mm^{-3} sponge. Whereas the copies number of bacterial *amoA* increased 100 to 1000-fold than initial condition and reached at approximately 5×10^5 copies mm^{-3} sponge. The solution was collected from sponge of DHS and was conducted to isolate nitrifying microorganisms using pour culture method at the 0.4 mM of NH_4^+. It was shown that some colonies possessed bacterial *amoA* and were capable of converting NH_4^+ to NO_2^-, indicating that nitrifying microorganisms grown on a low concentration of NH_4^+ were isolated from the eutrophied brackish lake. It was expected that these microorganisms give clues to understand nitrifying process and to clean up the eutrophied environments.

Keywords: Nitrogen cycle, Nitrification, Ammonia-oxidizing archaea, Down-flow Hanging Sponge reactor, eutrophic brackish lake

Characterization of Rechargeable Minerals Produced by Microorganism

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Microbial fuel cell (MFC) is capable of generate electricity directly from organic wastes by biochemical activity of microorganisms, therefore, MFC is expected as a novel energy-producing device. However it is too low current density to use practical application. It is indicated that an extracellular electron transfer is one of important key mechanisms for enhancement of current production. Fortuitously, since an MFC produced suddenly higher current density for about one month compared. Bacteria were isolated from the surface of anode using six-well method just after highly current production finished, named them strains HK2, HK3 and HK4. Both strains HK2 and HK4 produced black compound, while strain HK3 produced white compound. Energy dispersive X-ray analyses showed that the black compounds consisted of iron and sulfur, while the white compound consisted of phosphorus and titanium. X-ray diffraction analyses demonstrated that the black and white compounds were crystal and amorphous structure, respectively. Diffraction pattern suggested that the black compound was Mackinawite ($Fe_{X+1}S$, X=0~0.11), indicating that the Mackinaeite was produced by biomineralization (The Mackinawite produced by strain HK2 and HK4 were named RBM_{HK2} and RBM_{HK4}, respectively). Interestingly, cyclic voltammetry analyses showed that the black compound had redox peaks, as surprisingly, the RBM_{HK2} and RBM_{HK4} were capable of recharging electricity. Scanning electron microscopy observation revealed that the RBM_{HK2} maintained rosette like and thin layer structure, while the RBM_{HK4} included approximately 50~100 nm particles additionally 54 μAh mg^{-1} and 33 μAh mg^{-1}, respectively. Whereas the charge and discharge capacitance of RBM_{HK4} changed from approximately 420 μAh mg^{-1} to 200 μAh mg^{-1} and from approximately 25 μAh mg^{-1} to 18 μAh mg^{-1}, respectively. When the RBM_{HK2} was added in an MFC with lactate as electron donor, the current density was approximately 100-fold higher than the control MFC after day 3. These results suggested that the RBM_{HK2} was a useful biomaterial for enhancing the extracellular electron transfer to improve the performance of MFC. Furthermore, it is expected that these biomaterials may be able to develop an MFC to a secondary buttery.

Keywords: *Microbial fuel cell, sulfate-reducing bacteria, biomineralization, Mackinawite ($Fe_{X+1}S$, X=0~0.11),*

Protein damaging mechanism of phenothiazine photosensitizers

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Photosensitized biomolecule damage is an important process of photodynamic anti-microbial chemotherapy (PACT), which is medical application of photochemical reaction. PACT can treat sinusitis and periodontal disease. For example, methylene blue (MB) is used as a photosensitizer for sinusitis treatment. Applied photosensitizers are illuminated with a non-thermal visible light, resulting in the photosensitized reaction and biomolecules damage of pathogenic bacteria. Since PACT induces a physical damage to bacteria, a drug-resistant bacteria is rarely formed after the treatment. In general, the important mechanism of PACT is considered to be the generation of singlet oxygen ($^1O_2$), one of the reactive oxygen species, through energy transfer from photoexcited photosensitizer to molecular oxygen. However, the microenvironment of PACT reaction is hypoxia condition. Therefore, another mechanism might contribute to PACT. In this study, we examine the protein damage photosensitized by phenothiazine dyes, MB, azure A (AZA), azure B (AZB), and new methylene blue (NMB) (Fig. 1) to investigate the PACT mechanism.

Photosensitizers and human serum albumin (HSA), a water-soluble protein, were mixed in a 10 mM sodium phosphate buffer (pH 7.6) to be illuminated with a light-emitting diode (maximum wavelength: 659 nm, 1 mW cm^{-2}). The protein damage was examined by a fluorometry of the intrinsic fluorescence of HSA.

Absorption spectra of MB, AZA, AZB and NMB were slightly red-shifted by the addition of HSA, indicating the interaction between these photosensitizers and HSA. Fluorescence intensity of HSA around 350 nm, assigned to the tryptophan residue, was decreased by the photo-irradiation with these photosensitizers. Tryptophan is easily oxidized by $^1O_2$ and other photochemical mechanism, leading to the decrease of fluorescence intensity. Protein damage could be evaluated quantitatively by this fluorometry. The protein damage was inhibited by the addition of sodium azide, a physical quencher of $^1O_2$, suggesting the contribution of $^1O_2$. However, an excess amount of sodium azide could not completely inhibit the photosensitized protein damage. These results could be explained by the contribution of another mechanism, such as electron transfer. Electron transfer mechanism is direct electron abstraction from biomolecule to the photoexcited photosensitizer. Because this mechanism does not require oxygen, the mechanism of sinusitis treatment by MB under hypoxia condition might be explained by the electron transfer.

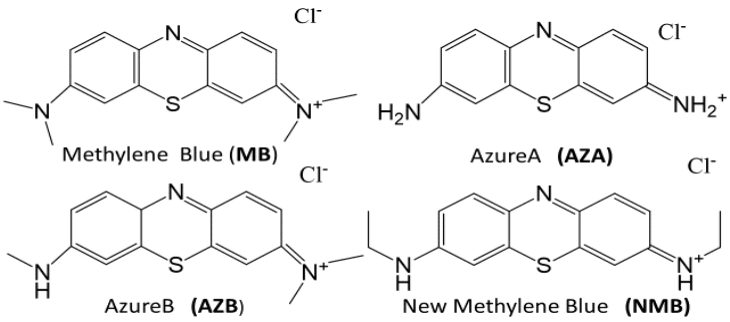

Fig. 1 Structures of phenothiazine photosensitizers

Oxidation of nicotinamide adenine dinucleotide photosensitized by diethoxy P(V)porphyrins

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Photodynamic therapy (PDT) has been noticed as a promising less invasive cancer treatment by using photochemical damage of biomolecules. After administration of non-toxic photosensitizer in dark, a point selective visible-light irradiation causes biomolecule damage, leading to apoptosis or necrosis of cancer cell. PDT is advantageous method for preservation of "quality of life" (QOL). Porphyrin derivatives have been studied and used as PDT photosensitizer. The important mechanism of PDT is the photosensitized generation of singlet oxygen ($^1O_2$). However, hypoxia condition of cancer cell may restrict the $^1O_2$-mediated PDT effect. Thus, we examined the biomolecule damaging activity of P(V)porphyrin derivatives, which can induce oxidation of DNA and protein through oxygen-independent electron transfer, as does the $^1O_2$-mediated mechanism. In this study, fluorinated P(V)porphyrin derivatives were used as photosensitizer (Fig. 1). As a targeting biomolecule, nicotinamide adenine dinucleotide (NADH) was used. NADH is ubiquitous endogenous reductant and easily oxidized. Oxidation of NADH can cause cytotoxicity.

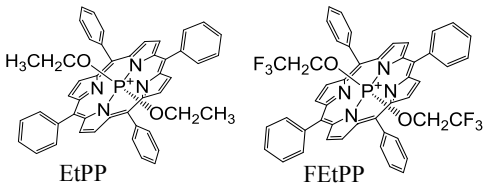

Fig. 1 Structures of P(V)porphyrins.

Sample solution containing 100 μM NADH and 5 μM P(V)porphyrins in 10 mM sodium phosphate buffer (pH7.6) was irradiated with a light-emitting diode (585 nm). Figure 2 shows the time course of NADH oxidation photosensitized by two kinds of P(V)porphyrin, EtPP and FEtPP, a fluorinated type of EtPP. Photo-irradiation without porphyrins does not induce NADH degradation. The addition of sodium azide (NaN_3), a quencher of $^1O_2$ partly inhibited NADH oxidation, suggesting the contribution of $^1O_2$. However, NaN_3 did not completely inhibit NADH oxidation. NADH oxidation with NaN_3 should be explained by the electron transfer. Table 1 shows the oxidation rate of NADH (R_{DC}), which is estimated from the initial degradation amount of NADH, and the contribution of the electron transfer- and $^1O_2$-mediated mechanisms. These results showed that the electron transfer-mediated NADH oxidation by EtPP is rather lager than that of FEtPP. Electron transfer-mediated mechanism may improve the PDT effect under hypoxic condition such as tumor.

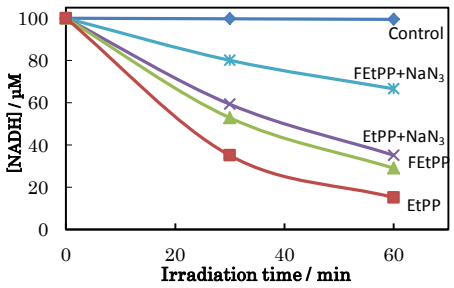

Fig.2 Time course of the NADH photo-oxidation by P(V)porphyrins

Table1. NADH photo-oxidation by P(V)porphyrins

Porphyrin	NaN_3/mM	R_{DC} /μMmin^{-1}	ET[%][(a)]	$^1O_2$[%][(b)]
EtPP	0	2.16	63	37
	50	1.36		
FEtPP	0	1.57	42	58
	50	0.66		

(a): Contribution of electron transfer mechanism

(b): Contribution of $^1O_2$ mechanism

Photo-irradiated folic acid can induce protein damage

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Photosensitized protein damage by endogenous photosensitizers is closely related to the mechanism of photo-aging. Folic acid, one of the B vitamin, is degradable by ultraviolet light, heat, and reactive oxygen species. Pterine-6-carboxylic acid (PCA), which is formed by degradation of folic acid, has a function as photosensitizer (Fig.1). It is known that PCA can damage DNA under ultraviolet-A (UVA, wavelength: 315 ~ 400 nm) irradiation. Nevertheless, protein damaging activity of PCA has not been well clarified. In this study, damage of human serum albumin (HSA), a water-soluble protein, photosensitized by folic acid and PCA under UVA irradiation was demonstrated.

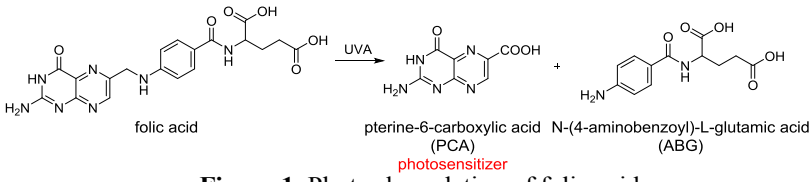

Figure 1. Photo-degradation of folic acid

The reaction mixtures containing 10 μM HSA and folic acid or PCA in sodium phosphate buffer (pH 7.6) were exposed to UVA light (λ = 365 nm, 0.86 mW/cm^2). After that, HSA damage was examined by the measurement of its intrinsic fluorescence of tryptophan residue on 298 nm excitation.

Figure 2 shows the time course of fluorescence intensity of HSA photosensitized by folic acid or PCA. Decrease of fluorescence intensity indicates the oxidative degradation of tryptophan residue. Without folic acid or PCA, HSA was hardly decomposed by UVA irradiation. Therefore, damage of HSA caused by photosensitized folic acid or PCA under UVA irradiation was demonstrated. Degradation rates of HSA exposing UVA light (120 min) were as follows: 49% (10 μM folic acid), 70% (20 μM folic acid), 32% (10 μM PCA), and 46% (20 μM PCA). Consequently, folic acid and PCA accelerated the damage of HSA in a concentration dependent manner. HSA degradation rate by folic acid was larger than that of PCA, suggesting the formation of other stronger photosensitizer during degradation of folic acid.

In conclusion, degradation products of UVA-irradiated folic acid and PCA can induce protein damage. Photochemical reaction of folic acid might contribute to photo-aging as does the photo-carcinogenesis through DNA damage.

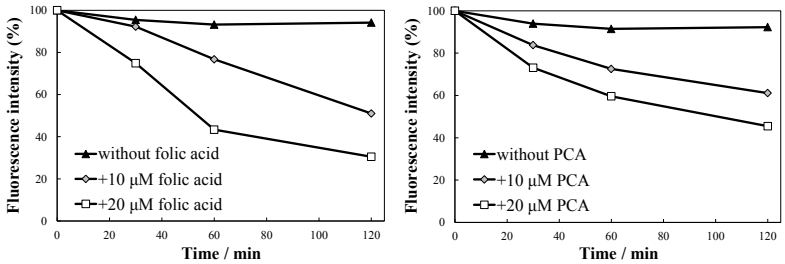

Figure 2. Time course of HSA fluorescence intensity photosensitized by folic acid (left) and PCA (right)

Keywords: Folic acid, Human serum albumin, Photosensitized damage

FEASIBILITY OF ATMOSPHERIC ARGON PLASMA FOR IMPROVING TRANSDERMAL DRUG ABSORPTION

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Drug delivery through the skin has been recognized as an important route. It has many advantages such as avoiding first-pass metabolism, gastrointestinal drug degradation compared to oral route and pain relief, reducing medical waste compared to hypodermic injections. However, the transdermal route is still limited to delivery of small, lipophilic and low-dose drugs. We investigated the effect of atmospheric pressure argon nonthermal plasma irradiation on reducing skin barrier function as a promising solution. Atmospheric pressure nonthermal plasma is becoming a subject of research interest, especially in medical field such as blood coagulation, wound healing or tissue regeneration. Its advantages including the formation of various highly reactive species (reactive oxygen species ROSs, reactive nitrogen species RNSs and so on) and no need of costly vacuum systems, are well known. Furthermore atmospheric pressure nonthermal plasma has been demonstrated to be appropriate for skin treatment in recent research reports. Our microplasma is a dielectric barrier discharge nonthermal plasma at atmospheric pressure. In this study an interaction between “Microplasma” and the stratum corneum, which is the outermost layer of a skin and plays a major role of barrier function of skin, was estimated. A Yucatan micropig skin was utilized as biological samples and was exposed to microplasma *ex vivo*. The disturbance in stratum corneum (SC) lipids after the treatment was suggested using Attenuated total reflection – Fourier transform infrared (ATR-FTIR) spectroscopy. In addition, increase of trans-epidermal water loss which is correlated closely with the SC barrier defect and no thermal damage on pig skins observed by a microscope were confirmed. The feasibility of microplasma irradiation for enhancing transdermal drug absorption was confirmed based on a comparison with the tape stripping effects.

Keywords: *Atmospheric microplasma, Dielectric barrier discharge, Skin barrier function*

A novel measurement technique based on a single-tip optical fiber probe for dense foam

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Foam is encountered in many industrial fields, and influences safety and efficiency of plants such as floatation, wastewater treatment. Conventional foam measurement techniques have the hard limitations of their equipment in order to utilize in the real machines. For example, we need a transparent vessel for the visualized measurement and many electrodes for the estimation using the electric conductivity. In the present study, we will propose a new foam measurement technique using a single tip optical fiber probe (S-TOP). The S-TOP is one of the optical fiber probes uniquely developed in our laboratory. Its optical device is small and it has great heat-resistance and tolerability; hence the S-TOP and its system are appropriate for practical processes in industries. In addition, the S-TOP possesses satisfactory performance to measure tiny foam cells; however its optical signals are very complex in foam measurement. We have developed a new 3D ray tracing simulation to analyze the optical probing signals. Based on the simulated results, we needed to find a falling signal in order to detect the contact of a film and the S-TOP. Furthermore, we carried out two kinds of experiments; the one was an experiment of two thin soap films and the other was an experiment of dense foam. A problem was that foam cells were broken by contact of the S-TOP. In these experiments, the surface of the S-TOP was changed to hydrophilic by the surface treatment in order to prevent the foam burst. As a result, comparing the average equivalent diameter of the visualization and the average chord length by the S-TOP measurement, the difference between these results was -8.89 %.

Keywords: *measurement technique, single tip optical fiber probe, dense foam, chord length*

Influences of bubble-surface contamination on bubble motion, bubble-induced surrounding liquid motion and mass transfer

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Mass transfer from a bubble to the surrounding liquid plays an important role in chemical engineering processes. To improve the efficiency and safety of the processes, a deep understanding of the mass transfer mechanism from bubbles to the surrounding liquid is essential. In our study, we examined a CO2 single bubble of 2~3 mm in equivalent diameter, that ascended zigzag, in purified water and contaminated water (500ppm 1-pentanol solution). We used two high speed camera systems with high spatial and temporal resolution, from 2 orthogonal directions, for visualization of the bubble wake and bubble-induced surrounding liquid motion.

The dissolution process of CO2 was visualized via LIF/HPTS (Laser Induced Fluorescence) method. HPTS, which is a fluorescent substance, was excited by Ar ion laser with a wavelength of 488 nm, then emitted with a wavelength of 513 nm. A pH level of the surrounding liquid of the bubble decreased with the increase of CO2 dissolution; hence the emission intensity of HPTS was reduced. As a result, the dark regions observed below the bubble rear accorded with the bubble wakes; from the wakes visualized with the high speed video cameras, dynamical CO2 dissolution process was obtained. In the purified water, the bubble shape was oblate ellipsoid, and horse-shoe-like vortices were formed in the rear of the bubble. On the other hand, in the contaminated water, the bubble represented more closely spheroidal. Furthermore, behavior of the vortices changed. These different results in two conditions were raised from the bubble surface contamination which reduces the surface tension. While the bubble ascended, the non-uniform distribution of the surfactant which adsorbed on the bubble surface occurred. Hence, a gradient of the surface tension was formed on the bubble surface, furthermore, it caused the Marangoni convection.

Keywords: *bubble, mass transfer, PIV, LIF/HPTS*

POTENTIAL DESCRIPTION OF α+^{90}Zr ELASTIC SCATTERING USING MODIFIED SINGLE-FOLDED POTENTIALS

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Alpha-nucleus interaction is enigmatic because of its idiosyncratic feature of the enhancement of cross-section at large angles observed in the elastic scattering of α particles as well as non-elastic processes. The present work reports the analyses of the elastic scattering of α particles from ^{90}Zr at different incident energies in terms of the modified single-folded (MSF) potentials. The conventional folded potentials, including double-folded and single-folded, need renormalizations at different incident energies. However, the MSF potentials, which is semi-microscopic in nature and generated from single-folding model, does not need any renormalization over a broad range of incident α energies. In this folding model, the nucleons in the target nucleus are considered primarily in α clusters and rest of the time unclustered nucleonic configuration. In this work, α+^{90}Zr elastic scattering data are fitted at 7 energy points in the range of 40.0-166.0 MeV to derive the MSF α+^{90}Zr potential. The best fit parameters yield at $4A_\alpha = 80$, $A_N = 10$, $A = 90$ with the renormalization factor N_r is exactly 1.

Keywords: Elastic scattering, Optical model, Folded potential, Renormalization.

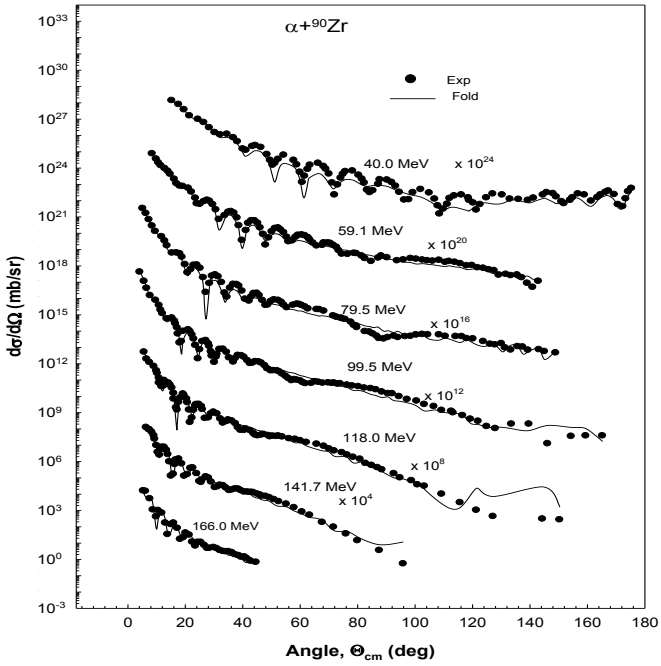

FIGURE: Differential cross-sections for the elastic scattering at different incident energies are compared to the predictions from the modified folded potentials (solid curves).

THE FORMATION OF BIPOLAR PULSED ARC DISCHARGE FOR THE EFFICIENT PRODUCTION OF SINGLE-WALLED CARBON NANOTUBES

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An innovative bipolar pulsed arc discharge method has been developed for the efficient production of single-walled carbon nanotubes (SWNTs) by using a bipolar pulsed current circuit with controlled current and pulse duration. Two graphite electrodes containing a metal catalyst (Ni+Y) is used in this setup and both electrodes sublimate carbon alternately at roughly the same rate. After the discharge, there are no carbon deposits on the both electrodes which mean that all the sublimated carbon becomes soot containing single-walled nanotubes. It is found that the soot production rate increases with increasing frequency whereas the quality of the produced SWNTs remains almost the same. The bipolar pulsed arc discharge has a good production rate of SWNTs when the pulse frequency is 0.05-2 Hz. The carbon sublimation rate and the deposition rate of the bipolar pulsed arc discharge method are compared with those of the DC, the AC, and the unipolar pulsed arc discharge methods. The nanostructures of the synthesized SWNTs are characterized by a TEM, TG/DTA, and Raman spectroscopy. High magnification TEM image shows that the bipolar pulsed arc discharge has a tendency to produce thicker bundles of SWNTs. The average numbers of SWNTs in a bundle are 3 to 4 and the tube diameters are approximately 1.0-1.5 nm. This diameters result is in good agreement with the results obtained from the Raman experiment. High magnification TEM image shows that the bipolar pulsed arc discharge has a tendency to produce thicker bundles of SWNTs. The average numbers of SWNTs in a bundle are 3 to 4 and the tube diameters are approximately 1.0-1.5 nm. This diameters result is in good agreement with the results obtained from the Raman experiment.

Keywords: SWNTs, arc discharge, input power, TEM, Raman spectroscopy

The behavior of *Komagataeibacter xylinus* on the coated NOC surfaces

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The Bacterial Cellulose (BC) consists of completely pure cellulose Nano fibrils synthesized by gram-negative bacterium. Recently, the BC has been extensively studied as a most promising material having versatile properties, e.g. biocompatibility, high water absorption capacity, high crystallinity, and high mechanical strength. In a previous report, the direction of the secretion and the epitaxial deposition of cellulose nanofibers on Nematic ordered cellulose (NOC) were controlled to follow the track direction, since the interactions between the cellulose fibers produced by *Komagataeibacter xylinus* and specific sites of the oriented molecules on the unique surface of NOC were very strong. In the surface structure of NOC as a template, the comprising cellulose molecular chains are oriented uniaxial and the hydroxymethyl groups at the C-6 position, which are equatorial bonded to the anhydroglucose unit, are vertically orientated to a certain angle against the surface, since NOC is prepares by uniaxial stretching of water-swollen cellulose. This indicates that the neighboring anhydroglucose ring planes are tilting and facing each other. Therefore, the hydrophilic and polarized OH groups are totally oriented as molecular tracks only in the stretching direction across the entire NOC surface. Simultaneously, the hydrophobic site due to the hydro glucose plane was also appeared between the two hydrophilic molecular tracks, resulting in both hydrophilic and hydrophobic tracks next to each other across the NOC surface. Concerning the condition of the templates, we studied the influential factors for the movement of the bacterium. We examined the behavior of *Komagataeibacter xylinus* on the Pt coated NOC surfaces. Firstly, NOC surfaces were coated with Pt (2-20 nm) by plasma ion coater. The coated NOC characterized by AFM (Atomic Force Microscope) and ATR-FTIR (Fourier transform infrared spectroscopy - Attenuated Total Reflection). The micro fibrils produced on the surfaces of NOC after cultivation were observed by SEM (Scanning Electron Microscope). The result revealed that Pt coated NOC is able to control the behavior of *Komagataeibacter xylinus*.

[1] Brown, (1989); Helenius et al., (2006); Klemm, Heublein, Fink, & Bohn, (2005); Yamanaka et al., (1989).

[2] Kondo, T. et al., Biomacromolecules, 2,1324 (2001).

[3] St. Hesse, Kondo, T., Carbohydrate Polymers, 60, 457–465 (2005).

Keywords: *cellulose, bacterium, Komagataeibacter xylinus*

Effect of Genes Related to Grain Size in Rice

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Crossing Koshihikari, a Japanese leading rice cultivar, with a large grain cultivar, and the offspring carrying the large grain are selected in the F_2 generation and then backcrossed three times with Koshihikari. Forwarding backcross will lead to rapid completion of a cultivar that has the same traits of Koshihikari except for the large grain. Next-Generation DNA Sequencing the whole genome in which the target large grain region narrows down by the continuous backcross would enable to discover the DNA mutation related to the large grain. This process is called genome-wide association analysis. Using the high-throughput, long-read next-generation sequencer, a library of 15-20 million reads (insert length 500 bp) was set up from 2 Gp, covering the rice genome size of over 400 Mb × 5. Clusters then be formed on flow cells and pair-end sequencing of 250-bp-long reads was performed. Reads sequences were mapped on the reference genome of Nipponbare. The size of rice grain increased by 18% in the BC_2F_2 generation. High yielding accompanied by the distinguishable large grain would give Japanese rice international competitiveness to overcome the oversea Koshihikari imported from USA or Australia by the TPP accord.

Keywords: *rice, Koshihikari, grain size, NGS*

ISOLATION AND STRUCTURE DETERMINATION OF NEW LASSO PEPTIDE SPHAERICIN FROM *PLANOMONOSPORA SPHAERICA*

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Lasso peptides are a kind of ribosomally-synthesized and posttranslationally-modified natural products with diverse bioactivities. They are produced by bacteria including α-proteobacteria and actinobacteria. Lasso peptides normally consist of 15-24 amino acid residues, which form a unique structure including the C-terminal tail pass through N-terminal macrolactam ring. In the previous study (Sherwood, E.J., et al. *J Bacteriol.* **2013**), methanol extract of *Planomonospora sphaerica* was reported to show antibacterial activity against *Micrococcus luteus*. However, the antibacterial principle has not been identified yet. To identify the antibacterial principle, we accomplished isolation and structure determination of the antibacterial compound of *P. sphaerica*. Firstly, *P. sphaerica* was cultured using ISP2 agar medium with incubation at 30 °C for 7days. The aerial hyphae and spore cells were harvested with a steel spatula. After the screening of antibacterial activity, a new antibacterial compound named sphaericin was isolated from methanol extract of the cells through several column chromatographic procedures. MALDI-TOF mass analysis revealed that the molecular weight of sphaericin was 2156.5 Da. Amino acid composition analysis of sphaericin gave totally 15 moles of amino acids (3 mole each of Gly, Ile, Pro, and 1 mole each of Arg, Glu, Leu, Phe, Ser, Tyr). NMR analyses including ^{1}H, ^{13}C, HSQC, HMBC, and NOESY indicated the presence of all the 15 amino acids which was detected by amino acid composition analysis and additional 3 mole of Trp. TOF-MS/MS analysis of sphaericin showed only partial structure of the C-terminal tail (from 10th to 18th residues). The proposed macrolactam ring part did not afford MS/MS fragmentation. The structure in macrolactam ring was not clear due to hardship of interpretation of NOESY spectrum. Now whole genome sequencing of *P. sphaerica* is on-going to clarify the peptide sequence from 1st to 9th. As a result of antibacterial test (paper disk method), sphaericin showed antibacterial activity with the dosage of 50 μg/disk against *M. luteus*.

Keywords: lasso peptide, *Planomonospora sphaerica*, MS/MS analysis

ISOLATION AND STRUCTURE DETERMINATION OF NEW LASSO PEPTIDE ACTINOKINEOSIN FROM *ACTINOKINEOSPORA SPHECIOSPONGIAE*

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Lasso peptide is defined to be a class of ribosomally biosynthesized and post-translationally modified peptides. Their common feature is that the C-terminal tail goes through an N-terminal macrolactam ring. This unique structure is the key to exert a wide variety of biological activities such as antibacterial activity. In previous studies, a lasso peptide propeptin was isolated from the mycelium of *Microbispora* sp. SNA-115 (Y. Esumi, et al. J. Antibiot. 2002) and it showed an inhibitory activity against prolyl endopeptidase (PEP, post-proline cleaving enzyme). The peptide sequence of propeptin was determined to be GYPWWDYRDLFGGHTFISP by MS/MS analysis. As a result on BLAST search based on amino acid sequence of propeptin, we found a propeptin homologue gene in the genome sequence of *A. spheciospongiae*. The biosynthetic gene cluster of actinokineosin was indicated to consist of 10 genes. Among the genes, the gene aknA encoded precursor of actinokineosin and the genes including aknB, aknC, and aknD were proposed to be modification enzymes to give mature actinokineosin. Based on the result of the genome mining, *A. spheciospongiae* was cultured with ISP2 agar medium to isolate the propeptin analogue peptide. The new propeptin analogue peptide, actinokineosin, was isolated from the methanol extract of cultured cells through several column chromatographic procedures. The linear C-terminal part of actinokineosin (10^{th} to 19^{th} residue) was determined by MS/MS analysis. To determine the cyclic peptide part, actinokineosin was treated with BNPS-skatole to cleave actinokineosin at the carboxyl residue of 5^{th} Trp. The peptide sequence of propeptin was determined to be GYPFWDNRDIFGGYTFIG, based on the results of HR-MS and the MS/MS analyses on the cleaved actinokineosin. As a result of antimicrobial activity test, actinokineosin showed antimicrobial activities against Gram-positive bacteria (*Micrococcus luteus*, *Bacillus subtilis*, and *Streptomyces antibioticus*).

Keywords: *Actinokineospora spheciospongiae*, lasso peptide, genome mining, MS/MS analysis, biosynthetic genes

ISOLATION AND STRUCTURE DETERMINATION OF NEW LASSO PEPTIDE CATTLECIN FROM *STREPTOMYCES CATTLEYA*

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Lasso peptides are ribosomally biosynthesized peptides produced by microorganism. Characteristic macrolactam ring in lasso peptide is formed through dehydration condensation of an amino group of the N-terminal amino acid and a carboxyl group of the acidic amino acid located in the peptide chain. It has a high thermal stability and high resistance to degradation by protease due to the macrolactam ring structure. Interestingly, a wide range of biological activities are known for these peptides, including an antibacterial activity and HIV-protease inhibition activity. Lasso peptides of actinobacteria were classified into three classes. The class I lasso peptide feature a cysteine residue at position 1 and commonly have additional two disulfide bridges composed of four cystein residue. The class II lasso peptide does not contain disulfide bond. The class III lasso peptide contain a glycine at position 1 and have one disulfide bond composed of two cysteine. Previously a lasso peptide sviceucin was discovered by genome mining and heterologous expression (Y. Li, *et al.* ACS Chem Biol. 2015). Based on genome mining for lasso peptide biosynthesis similar to sviceucin, we screened several actinomycetes producing lasso peptide by HPLC and ESI-MS analyses. As a result, *Streptomyces cattleya* was found to produce a new class II lasso peptide named cattlecin. Amino acid composition analysis of cattlecin indicated the presence of four moles each of Asp and His, three moles each of Gly and Tyr, and one mole of Ser. The MS/MS analysis on cattlecin revealed the amino acid sequence at the C-terminus was WHHGWYGWWDD. The peptide sequence of cattlecin was expected to be SYHWGDYHDWHHGWYGWWDD considering the biosynthetic gene (CCB72812.1). The Amino group of the 1st Ser was proposed to form the macrolactum ring with a carboxyl group of the 9th Asp, based on MS/MS data.

Keywords: *Streptomyces cattleya*, lasso peptide, genome-mining, MS/MS analysis

STRUCTURE DETERMINATION OF A SIDEROPHORE PEUCECHELIN FROM *STREPTOMYCES PEUCETIUS*

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Iron is essential for critical processes, such as respiration and DNA synthesis, in almost all life forms. Despite being one of the most abundant elements in the Earth's crust, the bioavailability of iron in many environments, such as the soil, is limited due to the very low aqueous solubility of the ferric ion. In iron deficient condition, some bacteria secrete siderophores which are defined as small molecular weight compounds with high-affinity of iron chelating. Previously, Park et al. isolated a new siderophore from Streptomyces peucetius ATCC 27952 based on information of the genome sequence and the structure of the siderophore was deduced to be a cyclic peptide based on MS/MS analysis. To clarify the structure of the siderophore, we cultured S. peucetius with iron deficient medium. Through several chromatographic procedures, the siderophore named peucechelin was isolated with the yield enough to perform NMR experiments. The planar structure of peucechelin was elucidated by the combination of ESI-MS experiment and NMR spectroscopic analyses of the gallium (III) complex. Unlike the previously deduced cyclic structure, the structure was determined to be a linear peptidewhich was similar to a known siderophore foroxymithine. The stereochemistries of amino acids constituting peucechelin were determined by applying modified Marfey method to the hydrolysate. Since the biosynthetic gene of peucechelin was formerly determined by Park et al. the similar genes were searched using genome data of other streptomycetes. As a result, the similar genes were found in the genome data of S. venezuelae and S. purpureus. Isolation and identification of siderophore was performed from the iron deficient culture of S. venezuelae. The siderophore of S. venezuelae was identified to be known compound foroxymithine by analysis ESI-MS and NMR spectra in the similar manner with peucechelin. Production of foroxymithine was also observed in the iron deficient culture of S. purpureus. Based on the genome data, comparison of the biosynthetic genes of structurally related siderophores peucechelin and foroxymithine was accomplished in discussion.

Keywords: siderophore, NMR, *Streptomyces peucetius*

Development of the aromatic wooden teaching material using compress-recovery process

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Graduate school of education, Japan

Japanese industrial technology (Monozukuri), which has been supported competitive manufacturing in the world, has been originated from relatively high personal technology literacy and hand-skill improved by making a wooden toy and playing tool from childhood. They start to naturally experience and learn newly - devised design, plan for making, material properties, cutting by knife and saw, assembling, and so on from own hand making. Especially, wood working plays important role in inheriting tradition and cultures, and developing them. Recently, however, children's playing is changing from making something to playing video games in day life. Thus, it becomes increasingly important to be provided opportunity of hand-making for children, according to the government course guidelines from elementary school on a step-by-step basis. In addition, Japanese technology education is needed to acquire technological literacy through experiential activity, and mainly conducted in junior high school.

This study was conducted to develop aromatic wooden material which has long term smell function with this process, in order to introduce into the teaching material in elementary and junior school. It was expected that aromatic wooden teaching material will give interest to the students on understanding scientific knowledge about wooden material, moreover it will give good influence on students by aromatic therapy like sweet smell or specialized function like anti-mosquito effect with natural Citronellal component.

As first step of this research, inserting mechanism and optimistic ratio of liquid by compress-recovery process on low density wood was verified, then maintenance for the smell and anti-mosquito effectiveness of aromatic material was evaluated, finally aromatic teaching material was suggested.

Consequently, inserting ratio of liquid by compress-recovery process showed 2 times higher than that of non-treated wood in an hour and relatively high percentage on the inserting ratio of liquid. And it was verified that the smell of these materials maintains relatively on long-term, due to be detected by not only test sensor but also human's nose over 150 days. It was shown relationship between solution concentration for essential oil and anti-mosquito effect on the aromatic wood. Moreover, in verification as teaching material, more than 95% of students felt ease in compress-recovery process. And about 85% of students marked "interesting" for changing wood in their answers.

We conclude that the aromatic wooden teaching material was proved on its effectiveness and potential.

Keywords: aromatic wooden teaching material, compress-recovery process, anti-mosquito effect

1 December, Tuesday: **Parallel event of** Inter-Academia Asia Young Researchers Conference

Program

December1st (Tue)
9:30～10:00 Registration

【1001 Conference Room】
10:00～10:05 Opening Address
General Manager of Headquarters for Promotion of Interdisciplinary Domain Research Prof. Takayuki Saito

～Commemorative Symposium for the MOU agreement～
10:10～10:35 Universiti Teknologi Malaysia Prof. Dr. Hesham El-Enshasy
Establishing strong cooperative framework in Education, Science, Technology,and knowledge based product development: A new Era for cooperation between Shizuoka University and Universiti Teknologi Malaysia
10:35～11:00 Shizuoka University Prof. Masakazu Hara
Research and development of heat tolerance enhancers in plants
11:00～11:25 Taylor's University Vice President Ms. Angela Pok
Setting the Stage for Student Experience Good Governance In a Globalized Education Environment
11:25～11:50 Shizuoka University Assoc. Prof. Junichi Asama
Novel Drive Method for Magnetic Bearings and Bearingless Motors Using One Three-Phase Inverter

11:50～12:30 Lunch
12:30～13:30 Student Poster Session

～Symposium for Promotion of Interdisciplinary Domain Research ～
13:30～13:55 Agency for Assessment and Application of Technology (BPPT) Dr. Sabar Pambudi
Research progress on dengue infection prevention in Indonesia
13:55～14:20 Universiti Teknologi Malaysia Prof. Mohamed Nasef
New radiation grafted functional polymers for renewable energy applications
14:20～14:45 International Rice Research Institute Dr. Shahjahan Kabir
14:45～15:10 King Mongkut`s Institute of Technology Prof. Dr. Wisanu Pecharapa
Metal Oxide Functional Materials Synthesized via Solution Route
15:10～15:30 Shizuoka University Prof. Masaru Shimomura
Self-assembling of Heteroaromatic Molecules on Silicon Surfaces for New electronic Devices
15:30～15:50 Shizuoka University Asst. Prof. Tetsuya Kouno
Optical biosensor based on whispering gallery mode in GaN microdisk
15:50～16:15 Indian Institutes of Technology Prof. Vinayak Eswaran
Numerical Simulation of Magnetohydrodynamics Flow and Heat Transfer in Enclosures and Ducts
16:15～16:40 Taylor's University Dr. Satesh Namasivayam
Addressing the Grand Challenges for Engineering Through Interdisciplinary Strategies: A Case Study of the School of Engineering, Taylor's University, Malaysia
16:40～16:55 Coffee Break
16:55～17:15 Open Discussion among all participants (Chair : Prof. Takayuki Saito)
『With focus on Asia, what should be the direction of Interdisciplinary Domain Research?』
17:15～17:30 Closing Address
Trustee of Shizuoka University, Director of Headquarters for Promotion of Interdisciplinary Domain Research Dr. Masakazu Kimura

18:00～19:30 Meeting for opinion exchange (6th floor Reception Hall)

Student Session [Field]
【1002 Conference Room】
10:10～11:50 [Engineering]
11:50～12:30 Lunch
13:30～16:10 [Science]
16:10～16:40 Feedback from Chairs

【1003 Conference Room】
10:10～11:10 [Science]
11:10～11:50 [Agriculture]
11:50～12:30 Lunch
13:30～14:30 [Agriculture]
14:30～15:30 [Humanities & Social Sciences]
15:30～16:10 [Education]
16:10～16:40 Feedback from Chairs

Shizuoka University