UPM MSSC RESEARCH INTERNSHIP IN JAPAN: INVITATION TO EXPERIENCE JAPANESE STYLE LAB MANNERS

Background

The MSSC (Super Satellite Campus) at UPM was established by Universiti Putra Malaysia (UPM) and Kyushu Institute of Technology (Kyutech) to promote and strengthen collaborative education and research between the two institutions. In conjunction with this effort, MSSC is inviting UPM local Master's students to apply for a research internship. Successful candidates will experience Japanese Style Lab Manners in Japan.

Eligible Candidates: UPM local Master's students in the specified fields/areas of study

Fields/Areas of Study

Biotechnology, Polymer Science, Chemical Engineering, Computer Simulation, Computer Science, Material Science

Period and Capacity

	Period	Capacity
1st group	from October 1st to December 27th, 2013	5
2nd group	from January 6th to March 31st, 2014	5

Sponsorship Information

UPM	Kyutech
Refer to SGS website for IRAMP	1. One room for 2 persons (same gender) for their stay during the internship period 2. 150,000JY for each group

Details of the Research Internship

The selected Master's students will conduct experiments in a research laboratory at the Graduate School of Life Science and Systems Engineering, Kyushu Institute of Technology, located at Hibikino 2-4, Wkamatsu-ku, Kitekyushu, Fukuoka 808-0196, Japan. Five research themes have been proposed by the participating researchers. Each student will be assigned a supervisor whose field of study is similar to him or her, to work on one of the proposed five research themes. The proposed themes and the required research backgrounds are shown below.

Selection of Internship Candidates

Selection will be based on a Skype interview with each candidate. The final selection of candidates is determined by the participating researchers who proposed the research themes.. The tentative date of the Skype interview is 10th September, 2013.

Individual Research Themes

No 1.

Title: Design of Functional Polymer from Palm Biomass

Proposing Researcher: Dr. Yoshito Andoh

Summary

In order to design sustainable materials from biomass in Malaysia, fatty acid from palm oil were investigated to produce polymerizable monomer using organic synthesis and enzymatic synthesis approaches. As studies in developing routes to polymers synthesis, the aim of this work is to examine the optimal process using the combination between organic synthesis and enzymatic synthesis approaches for synthesis of functional polymer as a valuable material from biomass.

Our present work consists of the development of model reaction for synthesis of polyester from fatty acids such as oleic, linoleic, palmitic and stearic acid, which are the major building blocks of palm oil. In order to obtain diacid compound from fatty acid which will be used as monomer or polyester synthesis, we choose two approaches to each type of fatty acids, respectively. The first approach is organic synthesis method for unsaturated fatty acids; another approach is enzymatic synthesis approach for saturated fatty acids. It is expected that polymer having some functionality will be able to be synthesized using corresponding diol and diacid compound through condensation process. The characterization of polyester will be evaluated by 1H and 13C-NMR, FT-IR, SEC, TG-DTA, and DSC. A new renewable bio-based polyester is expected to be designed, which will be beneficial for green technology and sustainable development.

Candidate Research Requirements

- Analytical chemistry, polymer chemistry, organic chemistry - for evaluation of the polyester properties; or
- Biochemistry, bioprocess technology, organic chemistry - for synthesis of diacids and polyester.

No. 2

Title: Metabolic Engineering to Enhance Bacterial Hydrogen Production from Glycerol by *Escherichia coli*

Proposing Researcher: Dr. Toshinari Maeda

Summary

Glycerol is a main byproduct from the biodiesel and has great potential as a feedstock for bioenergy production in the near future as indicated by the demand for biodiesel production.

This study is to enhance bacterial hydrogen production from glycerol by *Escherichia coli*, which is

a favourite subject to study its hydrogen producing capability because it owns a rather simple genome system which can be easily manipulated genetically. Recently, the fermentation flux from glucose by *E. coli* has been gradually elucidated; however, fermentation ability in *E. coli* impaired in the presence of glycerol, indicating slow growth and low hydrogen production. Hence, this remains a big gap and an interesting research area to find out other unknown genes or the metabolic pathway related to the hydrogen production from glycerol in *E. coli*. Here, random transposon mutagenesis is considered as a powerful genetic tool to explore the function of unknown gene(s) of *E. coli* regarding fermentation from glycerol and to understand the mechanism of glycerol metabolism under an anaerobic condition. Then, the unknown genes related to hydrogen production can be used for the metabolic engineering through inactivating unfavorable genes and/or expressing key genes. Taken together, this research aims to elucidate the metabolic flux toward hydrogen production in *E. coli* from glycerol. Thus from that basis, further metabolic engineering steps would be applied to enhance hydrogen production yield and to make bio-hydrogen more competitive. Technically, through the transposon mutagenesis, the genes related to glycerol metabolism can be determined and then the gene function can be verified how the genes could contribute to hydrogen production. Furthermore, the gene inactivation via P1 transduction and overexpression via cloning can be performed for metabolic engineering to enhance bacterial hydrogen production from glycerol.

Candidate Research Requirements

- Genetic engineering for molecular approach
- Fermentation for bioprocess approach

No.3

Title: Antimicrobial property of marine biopolymer based film

Proposing Researcher: Minato Wakisaka

Summary

Facile fabrication technique of free-standing film via hot-press molding from marine biopolymer such as alginate, carrageenan, chitosan, and their polyion complexes has been established.

Application of these films such as food packaging, oral mucosal drug delivery, wound dresser has been expected based on unique properties like biodegradability and biocompatibility of marine biopolymers. Another advantage especially for Muslim countries of using marine biopolymer is their origin different from other major edible material such as gelatin.

To explore this applicability, further characterization is necessary. Among various characterizations, examination of antimicrobial properties would be of first priority and our great interest for collaboration.

Candidate Research Requirements

- Basic skills of antimicrobial test
- Basic knowledge on food hydrocolloids

No. 4

Title: Thermodynamic properties of magnesium alloy studied by first-principles calculation

Proposing Researcher: Satoshi Iikubo

Summary

Magnesium-based alloys are attractive for many structural engineering applications owing to their low density and high specific strength. For example, the recently discovered long period stacking ordered (LPSO) Mg alloys have been reported to show a yield strength of 610 MPa and elongation of 5 % at room temperature as well as high thermal stability. Because the excellent mechanical properties seems to be connected with the characteristic crystal structure, the magnesium-based alloys attracts attention from the viewpoint of fundamental science.

On the basis of our previous study, the thermodynamic properties of hcp solid solution of the system has key role for the formation mechanism of the characteristic atomic or metallographic structures. Therefore we have investigated thermodynamic properties and phase stability of the related magnesium-based alloys systems. The hcp solid solution is metastable in many systems with magnesium, indicating that the experimental studies are difficult. Therefore, these studies have been mainly performed by using several calculation techniques, the first-principles calculations combined by cluster variation method and the calculation of phase diagrams (CALPHAD) technique.

Candidate Research Requirements

- Useful technical skills for the project
- Software: VASP, Wien2k
- Programming Languages: shell, Fortran
- Platforms: Linux
- Experimental Skills: XRD
- Expertise of thermodynamics, solid state physics, especially quantum mechanics and crystallography will help you to go on with the project.

No. 5

Title: Biofluid Dynamics using CFD（Computational Fluid Dynamics）

Proposing Researcher: Masaaki Tamagawa

Summary

In this internship program, the newly proposed computational programs will be developed to decrease the degree of hemolysis (damage of red blood cells) and thrombus (aggregation of blood), which are important problems for developing artificial hearts and medical fluidics. The target flow is blood flow on the pipe orifice with high Reynolds number including turbulence.

There are three steps in this internship program for developing computational programs based on conventional CFD (Computational Fluid Dynamics) method. They are (1) learning the fundamental computer programs (FORTRAN program) and executing the programs for validation using our previous experimental results, (2) learning fundamental blood flow phenomena in human body, (3) modification of the programs using newly proposed model by our laboratory, and comparison with the previous blood experiments such as hemolysis tests and thrombus tests.

From this internship program, the students can obtain the following skills; (1) total design method for developing special biomedical devices, (2) fundamental knowledge of biomechanics and bioengineering, (3) experiences for programming technique for CFD, which is useful to design the fluidics such as pumps and flow circuit for engineers using CAE (Computer Aided Engineering) in the companies.

Applicants who are interested in biomedical research field (artificial organs, bio fluidics and others) and also biomedical companies are welcome.

Candidate Research Requirements

Knowledge

- Physics
- Fluid Dynamics

(Fundamental Subjects in Faculty of Engineering, Science, others)

-Computational Fluid Dynamics (CFD) or

Partial Differential Equation (PDE) in Mathematics

Skills

-Programming Language; FORTRAN (or C)

(Preferable skills)

-Linux (OS)

How to Apply:

If you are interested in this internship programme, please email Prof Yoshihito Shirai, Director of MSSC, UPM at shirai@life.kyutech.ac.jp

Please identify the proposed research theme number you are interested in, and attach your CV, so that your field/area of study can be clearly identified.