

*e-ASIA Joint Research Program
Progress Report*

1. Project Title: Development of New Processes with Thermotolerant Microbes for Bio-refinery Including Biofuels, towards Utilization of ASEAN Biomass

2. Joint Research Period: April 1, 2017 ~ March 31, 2020

3. Principal Investigators:

- Japan: Prof. Mamoru Yamada, Yamaguchi University
 - Planned Funding Period: April 1, 2017 ~ March 31, 2020
- Thailand: Prof. Savitree Limtong, Kasetsart University
 - Planned Funding Period: in-kind
- Indonesia: Prof. Anton Muhibuddin, University of Brawijaya
 - Planned Funding Period: December 4, 2017 ~ March 31, 2020
- Lao PDR: Assoc. Prof. Somchanh Bounphanmy, National University of Laos
 - Planned Funding Period: in-kind

4. Summary of the Progress of the Joint Research:

WP1: (1) Joint research with the Indonesian and Laos teams on “Ethanol fermentation from the starch biomass by yeasts”: We first isolated 79 yeast strains from Indonesia under high-temperature conditions. Of these, efficient 3 strains (2 species) were subjected to cultivation under a stress condition to develop robust strains. One isolated strain grew well at 45 °C and became resistant to ethanol and furfural and showed high ethanol productivity at 43 °C. Similarly, of 159 strains isolated from Laos, efficient 5 strains (3 species) were subjected to cultivation under a stress condition. Strains derived from 2 species grew well at 46-47 °C and showed high fermentation ability at 43 °C, where their parents could not grow, and increase in resistance to ethanol and acetic acid. (2) Joint research with the Thai team on “Ethanol fermentation from the lignocellulosic biomass by yeasts”, a simultaneous saccharification and fermentation (SSF) with sugarcane tops was performed. Optimal condition was settled by using the experimental design matrices. Under the condition, a thermotolerant yeast produced only 12.5 g/L ethanol from 137 g/L sugarcane top. While, two efficiently xylose-fermenting yeasts produced about 38 g/L ethanol. (3) Joint research with the Japanese team of WP4: With feed rice, a thermotolerant yeast showed efficient achievement of separated hydrolysis and fermentation (SHF) and SSF up to 43 °C. After fermentation, ethanol was concentrated by distillation under a reduced pressure and provided to WP4. WP2: We isolated mutant acetic acid bacteria adapted to high temperature and low nutrients to meet vinegar production conditions in vinegar brewery companies. Our adapted strains performed acetic acid fermentation at 37°C

from “Moromi”, which is feedstock for Japanese rice vinegar by using “aceto-fermenter” a specialized equipment for vinegar production. In order to understand the biological basis for such the adaptation, we reconstituted the mutant strain that has a selected mutation in the gene for oxidoreductase in fatty acid synthesis. The mutant strain showed good growth even under low nutrient conditions likely to the adapted strain.

WP3: (1) Meta-fermentation production of L-lactic acid from food waste as a material for recyclable bioplastic was investigated to simplify bacterial members involved to the fermentation. As a result, we successfully selected three important thermotolerant bacterial strains, *Bacillus coagulans*, *Bacillus thermoamylovorans*, and *Bacillus hisashii*, mixed seed of which were found to be enough to produce equally level of optically pure L-lactic acid produced by the original mixed culture seed. Now we are ready to investigate specific functions of each strains in the meta- L-lactic fermentation. (2) Optimization of ABE fermentation using *Clostridium saccharoperbutylacetone* N1-4 was performed to avoid carbon-catabolite repression (CCR). Partially hydrolysate of rice straw (lignocellulose), a mixed sugar solution of cellobiose/ xylose (1:1) was artificially prepared and used. As a result, Inhibition ratio of CCR and productivity of bio-butanol were much improved. Continuous ABE fermentation was also investigated and achieved high-rate consumption of xylose and accumulation of ABE. (3) Members in KU optimized production system of L-lactic acid using a newly isolated thermotolerant fungal strain. KKKU member found that newly isolated thermotolerant bacterial strain accumulated high concentration of optically pure L-lactic acid from sucrose.

WP4: Developments of inorganic membranes have been carried out to improve the membrane stability to acidic solutions. Membranes were tested with synthetic solutions and with solutions obtained after a single distillation of real-fermented broth. A membrane unit combined with fermentation is under evaluation, which is supported by the both-way mobility between partners. For example, in March 2018, Dr. Izumi Kumakiri and 2 bachelor students visited the faculty of engineering and industrial technology, Silpakorn University, Thailand. During the visit, design of a simple membrane test rig was discussed. In this way, knowledge of zeolite membrane testing was transferred. In addition, exchanging a memorandum of understanding (MoU) was discussed, which was signed in May 2019. Yamaguchi University hosted Dr. Worapon Kiatkittipong from Silpakorn University, Thailand from 25 to 29 March 2019. Future planning on fermentation-membrane integration and student mobility were discussed.

WP5: Consolidated bioprocessing (CBP), in which enzyme production, polysaccharide hydrolysis and fermentation are carried out by a single microorganism, usually genetically modified one, is a cost effective process and was proposed over 30 years ago. However, it has not been applied in industrial production, In this project, we prepared CBP system to produce ethanol from starch using genetically modified yeasts to know and solve problems in CBP.

First, we expressed glucoamylases in yeasts, *Saccharomyces cerevisiae* and *Kluyveromyces marxianus*. Both yeasts produced ethanol from starch. However, ethanol yield was about a half compared with glucose as a substrate. Further analysis revealed that α -1,6 bonds in starch were not degraded and that prevented complete saccharification. These results indicate that lower secretory

production of α -1,6-degrading enzymes by yeasts may be the problem for efficient CBP.

5. Scientific Achievements and Implemented Activities (Research Exchange, Workshop, Publication, etc. if any):

**For this item, please fill in the attached Excel file.*

6. Future Goals and Plan of Activities within and after the project period:

WP1: We plan to acquire thermotolerant and tough strains from yeasts isolated in Thai, Indonesia and Laos, for high-temperature fermentation or temperature-uncontrolled fermentation and to develop effective fermentation by these strains, using agricultural residues, cellulosic biomass for Thai and starch biomass for Indonesia and Laos.

WP2: We try to understand common strategy(s) in microbes, if any, for increasing growth-limiting temperature. We like to establish a high-temperature vinegar production system to meet the standards in vinegar brewery companies. Another aspect in applied microbiology at high temperature, we hope we would find new microbes can produce valuable compounds at much higher temperatures, such as at 50°C. We like to continue isolating microbes from nature to find new interesting ones.

WP3: Synergetic and biorefinery production system of bioplastic monomer, L-lactic acid and future biofuel, n-butanol would be developed.

WP4: Clarify the influence of contaminants on membrane properties and propose a way to maintain the properties. Propose a system combining fermentation and membrane separation and demonstrate it in a small scale

WP5: Secretory production of an α -1,6-glucosidic bond-degrading enzyme by yeast will be achieved for complete consumption of starch and efficient ethanol production by CBP.

7. Recommendations and Comments to the Program (if any):

(ex. Any support to request from the Program in order to achieve item 6.)

Lists of Achievements and Implemented Activities

1. Original Publication of Articles etc.

1. 1 Original Publications (Articles co-authored among Research Teams)

All Authors' Names, Title, Journal Name, Volume, Edition, Page, Year of Publication	DOI Code	Publication Status	Remarks (e.g. publication in top level journals etc.)
Srisakul Trakarnpaiboon, Nantana Srisuk, Kuakoon Piyachomkwan, Kenji Sakai, Vichien Kitpreechavanich, Enhanced production of raw starch degrading enzyme using agro-industrial waste mixtures by thermotolerant <i>Rhizopus microsporus</i> for raw cassava chip saccharification in ethanol production. <i>Prep. Biochem. Biotechnol.</i> ,	doi.org/10.1080/10826068.2017.1342264	published	Jul18,2017 Published
Yakushi T, Fukunari S, Kodama T, Matsutani M, Nina S, Kataoka N, Theeragool G, Matsushita K. Role of a membrane-bound aldehyde dehydrogenase complex AldFGH in acetic acid fermentation with <i>Acetobacter pasteurianus</i> SKU1108. <i>Appl Microbiol Biotechnol.</i> 102 (10): 4549–4561 (2018)	doi: 10.1007/s00253-018-8940-6.	published	Apr3,2018 Published
Kallayanee Naloka, Pattaraporn Yukphan, Kazunobu Matsushita and Gunjana Theeragool Molecular Taxonomy and Characterization of Thermotolerant <i>Komagataeibacter</i> Species for Bacterial Nanocellulose Production at High Temperatures <i>Chiang Mai J Sci</i> , 45 (4): 1610–1622 (2018)	none	published	Jul,2018 Published
Gunjana Theeragool, Nittaya Pitiwittayakul, Minenosuke Matsutani and Kazunobu Matsushita Disruption of the groEL Gene Revealed A Physiological Role for Chaperonin in the Thermotolerant Acetic Acid Bacterium, <i>Acetobacter pasteurianus</i> SKU1108 <i>Chiang Mai J Sci</i> , 45 (4): 1623–1633 (2018)	none	published	Jul,2018 Published
Mochamad Nurcholis, Sukanya Nitiyon, Suprayogi, Nadchanok Rodrussamee, Noppon Lertwattanasakul, Savitree Limtong, Tomoyuki Kosaka and Mamoru Yamada: Functional analysis of Mig1 and Rag5 as expressional regulators in thermotolerant yeast <i>Kluyveromyces marxianus</i> . <i>Appl. Microbiol. Biotechnol.</i> , 2018	DOI:10.1007/s00253-018-9462-y	published	Nov5,2018 Published
Tomoyuki Kosaka, Noppon Lertwattanasakul, Nadchanok Rodrussamee, Mochamad Nurcholis, Ngo Thi Phuong Dung, Chansom Keo-Oudone, Masayuki Murata, Peter Götz, Constantinos Theodoropoulos, Suprayogi, Jaya Mahar Maligan, Savitree Limtong and Mamoru Yamada: Potential of thermotolerant ethanologenic yeasts isolated from ASEAN countries and their application in high-temperature fermentation. In <i>Fuel Ethanol Production from Sugarcane</i> . Thalita Peixoto Basso and Luiz Carlos Basso (eds) ISBN: 978-1-78984-937-0 (print) 978-1-78984-937-7 (online) IntechOpen, pp121–154, 2018	DOI: 10.5772/intechopen	published	Nov5, 2018 Published
Sornsiri Pattanakittivorakul, Noppon Lertwattanasakul, Mamoru Yamada, Savitree Limtong: Selection of thermotolerant <i>Saccharomyces cerevisiae</i> for high temperature ethanol production from molasses and increasing ethanol production by strain improvement. <i>Antonie van Leeuwenhoek</i> , 2019	Doi: 10.1007/s10482-019-01230-6	published	Jan21,2019 Published

Konjanda, P., T. Yakushi, K. Matsushita and G. Theeragool. 2019. Enhanced growth and ethanol oxidation by overexpressed caiA gene encoding acyl-CoA dehydrogenase in Komagataeibacter medellinensis NBRC 3288. Chiang Mai J. Sci. 46 (2). 196 – 206 (2019)	none	published	Mar,2019 Published
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8 Total

1. 2 Original Publications (Articles by Single Team only)

All Authors' Names, Title, Journal Name, Volume, Edition, Page, Year of Publication	DOI Code	Publication Status	Remarks (e.g. publication in top level journals etc.)	Country name of the team
Srisakul Trakarnpaiboon, Nantana Srisuk, Kuakoon Piyachomkwan, Shang-Tian Yang, Vichien Kitpreechavanich, L-Lactic acid production from liquefied cassava starch by thermotolerant <i>Rhizopus microsporus</i> : Characterization and optimization. Process Biochem., 63, 26–34, 2017	doi.org/10.1016/j.procbi.2017.08.019	published	Aug,2017 Published	Thailand
Srisakul Trakarnpaiboon, Suthasinee Praneetrattananon, Vichien Kitpreechavanich. Simultaneous Saccharification and Fermentation of L-(+)-Lactic Acid Production from Liquefied Cassava Starch by Immobilized <i>Rhizopus oryzae</i> in a 3 L Airlift Fermenter. Chiang Mai J. Sci., 45(1), 77–91, 2018	none	published	Jan,2018 Published	Thailand
Hirokuni Miyamaoto, Hisashi Miyamoto. Yukihiro Tashiro, Kenji Sakai, Hiroaki Kodama, "Studies on highly functional fermented-products made from un-utilized biomass resources by thermophilic bacteria", Journal of The Society for Biotechnology, Japan, Vol.96 No.2 pp56–63, 2018	none	published	The 26th Technical Award of the Society for Biotechnology	Japan
Ming Gao, Yukihiro Tashiro, Qunhui Wang, Kenji Sakai, Kenji Sonomoto, "High acetone–butanol–ethanol production in pH-stat co-feeding of acetate and glucose ", Journal of The Society for Biotechnology, Japan, Vol.96 No.2 pp68, 2018	none	published	The 25th Excellent Paper Award of the Society for Biotechnology	Japan
Tao Zhao, Yukihiro Tashiro, Jin Zheng, Kenji Sakai, Kenji Sonomoto, Semi-hydrolysis with low enzyme loading leads to highly effective butanol fermentation . Bioresour. Technol., 264, 335–342, 2018	doi.org/10.1016/j.biortech.2018.05.05	published	Sep,2018 Published	Japan
Matsutani M, Yakushi T. Pyrroloquinoline quinone-dependent dehydrogenases of acetic acid bacteria. Appl Microbiol Biotechnol. 102, pp 9531–9540, 2018	doi: 10.1007/s00253-018-9360-3.	published	Sep15,2018 Published	Japan
Rizki Fitria Darmayanti, Yukihiro Tashiro, Takuya Noguchi, Ming Gao, Kenji Sakai, Kenji Sonomoto. Novel biobutanol fermentation at a large extractant volume ratio using immobilized <i>Clostridium saccharoperbutylacetonicum</i> N1-4. J. Biosci. Bioeng., 126(6) 750–757, 2018	doi.org/10.1016/j.jbiosc.2018.06.006	published	Dec,2018 Published	Japan
Misumi Y, Nishioka S, Fukuda A, Uemura T, Nakamura M, Hoshida H, Akada R., YHp as a highly stable, hyper-copy, hyper-expression plasmid constructed using a full 2- μ m circle sequence in <i>cir0</i> strains of <i>Saccharomyces cerevisiae</i> ., Yeast. 2018 Dec 7 [Epub ahead of print]	10.1002/yea.3371	published	Dec7,2018 Published	Japan
Tao Zhao, Kento Yasuda, Yukihiro Tashiro, Rizki Fitria Darmayanti, Kenji Sakai, Kenji Sonomoto. Semi-hydrolysate of paper pulp without pretreatment enables a consolidated fermentation system with in situ product recovery for the production of butanol.Bioresour. Technol., 278, 57–65, 2019	doi.org/10.1016/j.biortech.2019.01.043	published	Mar,2019 Published	Japan

9 Total

Lists of Achievements and Implemented Activities

2. presentations at Academic Conferences etc. (Seminars, Workshops, Symposia)

2. 1 Conference Presentations (Joint Presentations among Research Teams)

Date	Type of Presentation	Speaker, "Title", Conference Name, Location, etc.
Aug26,2017	Oral Presentation	Toshiharu Yakushi, Naoya Kataoka, Gunjana Theeragool, and Kazunobu Matsushita, High temperature acetic acid fermentation: Molecular basis on thermotolerance and application, e-Asia JRP kick-off meeting, Bangkok
Sep4-5,2017	Guest/Invited Speaker	Gunjana Theeragool, Kallayanee Naloka, Pornchanok Taweecheep, Minenosuke Matsutani, Toshiharu Yakushi and Kazunobu Matsushita. "Improvement of Vinegar and Bacterial Nanocellulose Fermentation at High Temperatures by Adaptive Mutation." The 4th Sattelite Seminar in Core to Core Program, abstract, p16, Sep 4-5, 2017, Berlin, Germany
Sep4-5,2017	Oral Presentation	Sornsiri Pattanakittivorakul, Noppon Lertwattanasakul, Mamoru Yamada and Savitree Limtong: Effects of ethanol and sugar concentration on growth and ethanol fermentation of thermotolerant yeasts and increasing of ethanol fermentation by adaptation and mutagenesis. The 4th Sattelite Seminar in Core to Core Program, abstract, p20, Sep 4-5, 2017, Berlin, Germany
Mar17,2018	Oral Presentation	Seiya Fukunari, Minenosuke Matsutani, Toshiharu Yakushi, Naoya Kataoka, Gunjana Theeragool, Kazunobu Matsushita, "Expression of different molecular species of membrane-bound aldehyde dehydrogenases in acetic acid bacteria" The 2018 Annual Meeting of the Japan Society for Bioscience, Biotechnology and Agrochemistry, Nagoya, Japan
May26-27,2018	Oral Presentation	Megumi Ichiki, Shun Nina, Minenosuke Matsutani, Naoya Kataoka, Toshiharu Yakushi, Gunjana Theeragool, Kazunobu Matsushita, "Characterization of the membrane-bound aldehyde dehydrogenase responsible for acetic acid fermentation by Acetobacter sp." The Annual Meeting of the Japanese Biochemical science, Chu-shikoku Branch, Yonago, Japan
Sep20-21,2018	Oral Presentation	Toshiharu Yakushi, Hina Mukai, Nittaya Pitiwittayakul, Minenosuke Matsutani, Pornchanok Taweecheep, Naoya Kataoka, Gunjana Theeragool, Kazunobu Matsushita, "Characterization of the membrane-bound alcohol dehydrogenase of Komagataeibacter sp., a species of acetic acid bacteria" The 2018 Annual Meeting of the Japan Society for Bioscience, Biotechnology and Agrochemistry, Chu-shikoku Branch, Matsue, Japan
Oct23-24,2018	Oral Presentation	Suprayogi, F. K. Anggrarini Putri, Maleo, M. Nurcholis, A. Saputra, A. Muhibuddin, T. Kosaka and M. Yamada: Isolation of thermotolerant ethanol-fermenting yeasts from Indonesia and their identification and characterization. The 5 th Satellite Seminar and the 2 nd e-ASIA Joint Research Program, Program and Abstract, pp.28 Oct, 23-24, Luangprabang, Laos
Oct23-24,2018	Oral Presentation	Chansom Keo-Oudone, Mochamad Nurcholis, Noppon Lertwattanasakul, Somchanh Bounphanmy, Savitree Limtong and Mamoru Yamada: Screening and characterization of thermotolerant yeasts for ethanol fermentation with cassava starch at high temperatures. The 5th Satellite Seminar and the 2nd e-ASIA Joint Research Program, Program and Abstract, pp.27 Oct, 23-24, Luangprabang, Laos
Oct23-24,2018	Oral Presentation	Noppon Lertwattanasakul, Vipawee Najanthong, Tomoyuki Kosaka, Mamoru Yamada and Savitree Limtong: Ethanol production from sugarcane top by thermotolerant yeast Kluyveromyces marxianus DMKU 3-1042 using simultaneous saccharification and fermentation process. The 5th Satellite Seminar and the 2nd e-ASIA Joint Research Program, Program and Abstract, pp.26 Oct, 23-24, Luangprabang, Laos

Oct23–24,2018	Oral Presentation	Savitree Limtong, Thitinun Sumyai, Noppon Lertwattanasakul and Mamoru Yamada: Ethanol production from sugarcane top by newly selected xylose fermenting yeast strains. The 5th Satellite Seminar and the 2nd e-ASIA Joint Research Program, Program and Abstract, pp.13 Oct, 23–24, Luangprabang, Laos
Oct23–24,2018	Oral Presentation	Mamoru Yamada, Masayuki Murata, Tomoyuki Kosaka, Suprayogi, Sukanya Nitiyon, Chansom Keo–Oudone, Pornthap Thanonkeo, Nadchanok Rodrussamee, Noppon Lertwattanasakul and Savitree Limtong: Conversion of Biomass to ethanol by thermotolerant yeasts. The 5th Satellite Seminar and the 2nd e-ASIA Joint Research Program, Program and Abstract, pp.12 Oct, 23–24, Luangprabang, Laos
Oct23–24,2018	Oral Presentation	Toshiharu Yakushi, Nami Matsumoto, Hiromi Hattori, Minenosuke Matsutani, Chihiro Matayoshi, Hirohide Toyama, Naoya Kataoka, Kazunobu Matsushita: Thermotolerance acquired through metabolic change induced by inactivation of a transporter in <i>Gluconobacter</i> sp. strain CHM43. The 5th Satellite Seminar and the 2nd e-ASIA Joint Research Program, Program and Abstract, pp.18 Oct, 23–24, Luangprabang, Laos
Oct23–24,2018	Oral Presentation	Theeragool, G., T. Phathanathavorn, N. Naloka, T. Yakushi and K. Matsushita. Cost-effective Vinegar Fermentation at High Temperature by the Adapted Strains of <i>Acetobacter pasteurianus</i> SKU1108. The 5th Satellite Seminar and the 2nd e-ASIA Joint Research Program, Program and Abstract, pp. 29 Oct, 23–24, Luangprabang, Laos
Oct23–24,2018	Oral Presentation	Toulaphone Keokene, Chanhom Loinheuang, Toshiharu Yakushi, Gunjana Theeragool: Characterization and Identification of Acetic acid bacteria Isolated from samples collected in Lao PDR. The 5th Satellite Seminar and the 2nd e-ASIA Joint Research Program, Program and Abstract, pp. 30 Oct, 23–24, Luangprabang, Laos
Oct24,2018	Oral Presentation	Yukihiro Tashiro, Takeshi Zendo, Vichien Kitpreechavanich, Kenji Sonomoto, Kenji Sakai, Establish of efficient meta-fermentation process for optically pure lactic acid production from waste biomass using mixed culture system, The 2nd e-ASIA Joint Research Program Seminar, Louangprabang (Laos), Oct 24
Dec2–4,2018	Poster Session	Sornsiri Pattanakittivorakul, Noppon Lertwattanasakul, Mamoru Yamada and Savitree Limtong. Selection of thermotolerant strain of <i>Saccharomyces cerevisiae</i> for ethanol production from molasses at high temperature and strain improvement by adaptation and mutagenesis. Final Joint Seminar of CCP, Summary Book pp343–346, Dec Dec 2–4, 2018, Yamaguchi, Japan
Dec2–4,2018	Oral Presentation	Masayuki Murata, Isumi Kumakiri, Tomoyuki Kosaka, Pumin Nutaratat, Constantinos Theodoropoulos, Peter Gotz, Pornthap Thanonkeo, Savitree Limtong and Mamoru Yamada. Final Joint Seminar of CCP, Summary Book p335–338, Dec Dec 2–4, 2018, Yamaguchi, Japan
Dec2–4,2018	Poster Session	Suprayogi, Fika Ulan Anggrarini Putri, Maleo, Mochamad Nurcholis, Afriyagung Saputra, Anton Muhibuddin, Tomoyuki Kosaka and Mamoru Yamada: Isolation and characterization of thermotolerant yeasts isolated in Indonesia. Final Joint Seminar of CCP, Summary Book p73–76, Dec Dec 2–4, 2018, Yamaguchi, Japan
Dec2–4,2018	Oral Presentation	Mochamad Nurcholis, Suprayogi, Masayuki Murata, Minh T. Nguyen, Nadchanok Rodrussamee, Noppon Lertwattanasakul, Sukanya Nitiyon, Savitree Limtong, Tomoyuki Kosaka and Mamoru Yamada: Analysis of glucose repression mechanism in thermotolerant yeast <i>Kluyveromyces marxianus</i> , Final Joint Seminar of CCP, Summary Book p129–132, Dec 2–4, 2018, Yamaguchi, Japan
Dec2–4,2018	Oral Presentation	Noppon Lertwattanasakul, Tomoyuki Kosaka, Nadchanok Rodrussamee, Masayuki Murata, Suprayogi, Savitree Limtong and Mamoru Yamada: Complete genome sequence and transcriptome analyses of thermotolerant yeast <i>Kluyveromyces marxianus</i> DMKU 3–1042. Final Joint Seminar of CCP, Summary Book p113–116, Dec 2–4, 2018, Yamaguchi, Japan
Dec2–4,2018	Oral Presentation	Pitiwittayakul, N., P. Rattanawaree, S. Bureenok, T. Yakushi. Identification of acetic acid bacteria and assigned to the genus <i>Gluconobacter</i> by groEL gene sequence analysis. Final Joint Seminar of CCP, Summary Book p227–230, Dec 2–4, 2018, Yamaguchi, Japan
Dec2–4,2018	Oral Presentation	Theeragool, G., N. Naloka, P. Taweecheep, N. Pitiwittayakul, T. Keokene, T. Yakushi and K. Matsushita. Improvement of bacterial nanocellulose fermentation at high temperature by the adapted strains of thermotolerant <i>Komagataeiacet</i> . Final Joint Seminar of CCP, Summary Book p105–108, Dec 2–4, 2018, Yamaguchi, Japan
Mar24–27,2019	Oral Presentation	Nami Matsumoto, Naoki Osumi, Theerisara PHATHANATHAVORN, Riho Sueyoshi, Minenosuke Matsutani, Naoya Kataoka, Toshiharu Yakushi, Gunjana Theeragool, Yasushi Shiraishi, Kazunobu Matsushita, "Low-nutrition and thermal adaptation of <i>Acetobacter pasteurianus</i> for practical acetic acid fermentation" The 2019 Annual Meeting of the Japan Society for Bioscience, Biotechnology and Agrochemistry, Tokyo, Japan

2. 2 Conference Presentations (by Single Team)

Date	Type of Presentation	Speaker, "Title", Conference Name, Location etc.	Country name of the team
Jul25–28,2017	Guest/Invited Speaker	Mamoru Yamada (keynote lecture) Genomic aspects on thermotolerance, thermal adaptation and thermal stability, and application of thermotolerant microbes, the 7th FerVAAP & the 12th ABBS, Abstract p 4, July 25–28, 2017 Khon Kean, Thailand	Japan
Jul25–28,2017	Poster Session	Huynh Xuan Phong, Ngo Thi Phuong Dung, Preekamol Klanrit, Mamoru Yamada and Pornthap Thanonkeo: Ethanol production from pineapple waste by newly isolated thermotolerant yeasts, the 7th FerVAAP & the 12th ABBS, Abstract p 163, July 25–28, 2017 Khon Kean, Thailand	Japan
Jul26–27,2017	Oral Presentation	Toulaphone Keokene, Chansom Keo-oudone, Chanhom Loinheuang, Somchanh BOUNPHANMY, Manichanh SAYAVONG "Diversity of Ethanol Fermenting Yeast and Invertebrate Pathogenic Fungi Isolated from Lao PDR" The 7th International Conference on Fermentation Technology of Value Added Agricultural Products (Core to Core Session), Khon Kaen, Thailand, 26–27 July	Lao
Sep5,2017	Oral Presentation	Kenji Sonomoto, "Biobutanol Production with Designed Biomass on Biorefinery". The 4th Satellite Seminar, New Core to Core Program A. Advanced Research Networks on "Establishment of an international Research Core for New Bio-Research Fields with Microbes from Tropical Areas", Berlin (Germany), 2017/9/5	Japan
Sep5,2017	Oral Presentation	Yukihiro Tashiro, Kenji Sakai, "Establish of efficient meta-fermentation process for optically pure lactic acid production from waste biomass using mixed culture system", The 4th Satellite Seminar, New Core to Core Program A. Advanced Research Networks on "Establishment of an international Research Core for New Bio-Research Fields with Microbes from Tropical Areas", Berlin (Germany), 2017/9/5	Japan
Sep11,2017	Guest/Invited Speaker	Hirokuni Miyamaoto, Hisashi Miyamoto. Yukihiro Tashiro, Kenji Sakai, Hiroaki Kodama, "Studies on highly functional fermented-products made from un-utilized biomass resources by thermophilic bacteria" The 69th Annual Meeting of the Society for Biotechnology, Japan, Tokyo, Japan	Japan
Sep12,2017	Poster Session	Toshiharu Mizoguchi, Shunya Kohara, Yukihiro Tashiro, Hirokuni Miyamoto, Kenji Sakai, "Reconstruction of mixed culture system for meta-fermentation production of highly-optical L-lactic acid" The 69th Annual Meeting of the Society for Biotechnology, Japan, Tokyo, Japan	Japan
Sep12,2017	Poster Session	Rizki Darmayanti, Takuya Noguchi, Ming Gao, Yukihiro Tashiro, Kenji Sakai, Kenji Sonomoto, "High butanol production by immobilized extractive fermentation with large extractant volume", The 69th Annual Meeting of the Society for Biotechnology, Japan, Tokyo, Japan	Japan
Sep22,2017	Oral Presentation	Rina Nakanishi, Minenosuke Matsutani, Naoya Kataoka, Toshiharu Yakushi, Kazunobu Matsushita, "Elevation of thermotolerance by supplementation with C4-dicarboxylates and amino acids in <i>Acetobacter</i> sp.", The 2017 Joint Meeting of the Japan Society for Bioscience, Biotechnology and Agrochemistry, Kansai. Chu-shikoku and Nishi-Nihon branches, Osaka, Japan	Japan
Nov9,2017	Oral Presentation	Rizki Fitri Darmayanti, Takuya Noguchi, Ming Gao, Yukihiro Tashiro, Kenji Sakai, Kenji Sonomoto, "High Butanol Production on Extractive Fermentation with Large Extractant Volume by Immobilized Cells" International Symposium on Agricultural, Food, Environmental and Life Sciences in Asia, 2017, Kyushu University, 2017/11/9	Japan
Nov9,2017	Oral Presentation	Tao Zhao, Yukihiro Tashiro, Kenji Sakai, Kenji Sonomoto, "Repeated Enzymatic Hydrolysis and Acetone-Butanol-Ethanol Fermentation of Rice Straw Using Free and Immobilized Cells of <i>Clostridium saccharoperbutylacetonicum</i> N1-4". International Symposium on Agricultural, Food, Environmental and Life Sciences in Asia, 2017, Kyushu University, 2017/11/9	Japan
Nov9,2017	Poster Session	Kento Yasuda, Tao Zhao, Yukihiro Tashiro, Kenji Sakai and Kenji Sonomoto, "Butanol Fermentation with Designed Pulp Hydrolysates by <i>Clostridium saccharoperbutylacetonicum</i> N1-4". International Symposium on Agricultural, Food, Environmental and Life Sciences in Asia, 2017, Kyushu University, 2017/11/9	Japan
Nov24,2017	Oral Presentation	Chisato Kawasaki, Hisashi Hoshida, Rinji Akada, "Development of consolidated bioprocessing using the thermotolerant yeast <i>Kluyveromyces marxianus</i> for efficient ethanol production" The 35th YEAST WORKSHOP, Takamatsu, Japan	Japan

Dec6-9,2017	Poster Session	Tatsuya Tsuzuno, Seiki Nishida, Tomoyuki Kosaka, Isamu Miyakawa, Mamoru Yamada, "Metabolic change at high temperature in thermotolerant yeast <i>Kluyveromyces marxianus</i> " The 40th the Molecular Biology Society of Japan and the 90th the Japanese Biochemical Society Joint Annual Meeting, Kobe, Japan	Japan
Dec6-9,2017	Poster Session	Mamoru Yamada, Kannikar Charoensuk, Tomoko Sakurada, Amina Tokiyama, Masayuki Murata, Tomoyuki Kosaka, "Analysis of thermotolerant genes in thermotolerant <i>Zymomonas mobilis</i> and comparison of thermotolerant genes with those of other microbes" The 40th The Molecular Biology Society of Japan and The 90th The Japanese Biochemical Society Joint Annual Meeting, Kobe, Japan	Japan
Dec8,2017	Oral Presentation	Toshiharu Yakushi, Soemphol Wichai, Phong Huynh, Naoya Kataoka, Hirohide Toyama, Kazunobu Matsushita, "Molecular maturation process of the membrane-bound heterotrimeric sorbitol dehydrogenase of <i>Gluconobacter</i> sp.: Role of the small subunit SldS" The 40th The Molecular Biology Society of Japan and The 90th the Japanese Biochemical Society Joint Annual Meeting, Kobe, Japan	Japan
Mar3,2018	Oral Presentation	Naoyuki Aso, Yasuhiro Kajimura, Nunes Catarina, Izumi Kumakiri, Kazuhiro Tanaka, Hidetoshi Kita, "Effect of operating conditions on the dehydration performance of MOR-zeolite membranes" The 20th Annual Meeting of the Society of Chemical Engineers, Japan, Hiroshima, Japan	Japan
Mar3,2018	Oral Presentation	Ryutaro Kishibe, Nunes Catarina, Izumi Kumakiri, Kazuhiro Tanaka, Hidetoshi Kita, Mamoru Yamada, "Application of hydrophilic zeolite membrane for concentrating fermentation products", The 20th Annual Meeting of the Society of Chemical Engineers, Japan, Hiroshima, Japan	Japan
Mar16,2018	Oral Presentation	Yukihiro Tashiro, Yuki Ishida, Tomohiro Kimura, Yuki Okugawa, Hirokuni Miyamoto, Kenji Sakai, "Meta-fermentation production of high quality chemicals using various kinds of mixed culture seeds", The 2018 Annual Meeting of the Japan Society for Bioscience, Biotechnology and Agrochemistry, Nagoya, Japan	Japan
May18,2018	Oral Presentation	Rinji Akada, Yukie Misumi, Satoko Nishioka, Mako Enokida, Natsadaphon Saeliu, Shahira S. Aly, Sanom Nonklang, Yoshinori Sekiguchi, Akira Fukuda, Takeshi Uemura, Mikiko Nakamura, Hisashi Hoshida, Red fluorescent protein as a marker for protein production and genetic engineering in yeasts, Non-conventional yeasts: from basic research to application, University of Rzeszów, Poland, 2018,5/18	Japan
Jul16,2018	Oral Presentation	Mochamad Nurcholis, Tomoyuki Kosaka, Mamoru Yamada "Functional roles of MIG1 and RAG5 in thermotolerant yeast <i>Kluyveromyces marxianus</i> ", The 51th Lecture of the Japan Society for Bioscience, Biotechnology and Agrochemistry Chu-shikoku Branch, Yamaguchi, Japan	Japan
Sep4-7,2018	Oral Presentation	Masutani M, Matsumoto N, Yamashita T, Tatsuno M, Furukawa A, Sueyoshi R, Kataoka N, Yakushi T, and Matsushita K Natural mutation could alter the thermotolerance among closely related <i>Acetobacter pasteurianus</i> strains	Japan
Sep5,2018	Oral Presentation	Takuya Abe, Junya Hirota, Hisashi Hoshida, Rinji Akada, "Characterization of the thermotolerant-yeast <i>Kluyveromyces marxianus</i> strains for bioethanol production" The 70th Annual Meeting of the Society for Biotechnology, Japan, Osaka, Japan	Japan
Sep7,2018	Guest/Invited Speaker	Yukihiro Tashiro, Kenji Sakai, Hirokuni Miyamoto, "Fermentation production system studying on mixed culture system" The 71th Annual Meeting of the Society for Biotechnology, Japan, Osaka, Japan	Japan
Sep7,2018	Guest/Invited Speaker	Kenji Sonomoto, "Fermentation production system studying on medium, substrate, and downstream process" The 71th Annual Meeting of the Society for Biotechnology, Japan, Osaka, Japan	Japan
Sep18-20,2018	Poster Session	Ryutaro Kishibe, Izumi Kumakiri, Kazuhiro Tanaka, Hidetoshi Kita, Marino Hara, Tomoyuki Kosaka, Mamoru Yamada, "Application of zeolite membranes for a high temperature fermentation process" The 50th Autumn Meeting of the Society of Chemical Engineers, Japan, Kagoshima, Japan	Japan
Sep18-20,2018	Poster Session	Aso Naoyuki, Izumi Kumakiri, Kazuhiro Tanaka, Hidetoshi Kita, "Effect of acids on the permeation property of MOR-zeolite membranes" The 50th Autumn Meeting of the Society of Chemical Engineers, Japan, Kagoshima, Japan	Japan
Oct5-8,2018	Oral Presentation	Izumi Kumakiri, Mamoru Yamada, Javier Herguido and Miguel Menendez, "Micro-porous inorganic membranes - their unique dehydration properties and potential applications", 10th KIFEE, Norway, 2018/10/05-08	Japan
Nov17,2018	Poster Session	Takaharu Mizoguchi, Yukihiro Tashiro, Kenji Sakai, Reconstruction of a complex microbial system for producing optically pure L-lactic acid, JSBBA West 1st Student Forum, Fukuoka (Japan), 2018/11/17	Japan
Nov18-19,2018	Oral Presentation	Ryutaro Kishibe, Izumi Kumakiri, Kazuhiro Tanaka, Hidetoshi Kita, Marino Hara, Tomonori Kosaka and Mamoru Yamada, "Dehydration zeolite membranes applied to concentration ethanol produced by a high temperature fermentation", The 13th Young Scientist Seminar Seminar, Yamaguchi, Japan 2018/11/18-19	Japan
Dec1,2018	Oral Presentation	Toshiharu Mizoguchi, Yukihiro Tashiro, Kenji Sakai, "Reconstruction of meta-fermentation process for production of optically active L-lactic acid and functional analysis of bacteria" The 25th Annual Meeting of the Society for Biotechnology, Japan, Kyushu Branch, Kagoshima, Japan	Japan

Dec13,2018	Guest/Invited Speaker	Mamoru Yamada, "Bioethanol production by next-generation fermentation technology-Ethanol conversion of raw garbage and paper waste using thermotolerant microorganisms-, "Biomass / waste clothes / technology for utilization of ethanol derived from waste materials and power generation" Seminar, Tokyo, Japan	Japan
Dec18-20,2018	Poster Session	Yusuke Maruo, Yasuhiro Kajimura, Izumi, Kazuhiro Tanaka, Hidetoshi Kita, " Influence of synthesis conditions on the dehydration performance of MOR membranes", The 28th Annual Meeting of MRS-J, Kokura, Japan	Japan
Dec18-20,2018	Poster Session	Naoyuki Aso, Izumi, Kazuhiro Tanaka, Hidetoshi Kita, "Application of MOR-zeolite membranes in separation of acid solutions", The 28th Annual Meeting of MRS-J, Kokura, Japan	Japan
Dec18-20,2018	Poster Session	Takashi Myojin, Nunes Catarina, Izumi Kumakiri, Kazuhiro Tanaka, Hidetoshi Kita, "Influence of acids on the permeation property of MFI membranes" The 28th Annual Meeting of MRS-J, Kokura, Japan	Japan
Mar24-27,2019	Oral Presentation	Hiroki Agari, Rina Nakanishi, Nami Matsumoto, Naoya Kataoka, Toshiharu Yakushi, Kazunobu Matsushita, "Thermotolerant mechanism in experimentally evolved Acetobacter pasteurianus TH-3: relation with the cell surface and amino acid metabolism" The 2019 Annual Meeting of the Society for Bioscience, Biotechnology and Agrochemistry, Tokyo, Japan	Japan
Mar24-27,2019	Oral Presentation	Yukihiro Tashiro, Takaharu Mizoguchi, Shunya Kohara, Hirokuni Miyamoto, Kenji Sakai, "Reconstruction of meta-fermentation process using isolated strains for production of optically active L-lactic acid" The 2019 Annual Meeting of the Japan Society for Bioscience, Biotechnology and Agrochemistry, Tokyo, Japan	Japan

37 Total

Lists of Achievements and Implemented Activities

3. Workshops, Seminars, Symposia and Other Events (Organized by the Project)

Event duration	Name of Organizer	Title of the Event	Location (Country, City, Venue)	Number of Participants (Including Team Members)	Overview
August 26, 2017	Gunjana Theeragool, Mamoaru Yamada	e-ASIA kick off meeting	Thailand, Bangkok, Centara Grand Hotel	8	In the first meeting of this program, representatives of each WP gave a presentation focusing on the research plan. It was held by the NRCT support as a session of Thailand Research EXPO2017.
October 30, 2017	Toshiharu Yakushi	The 4th Seminar of Priority Universities for Cooperation in Japan	Yamaguchi, Yamaguchi University	40	A symposium was held at Yamaguchi Univ to have presentations including collaborative researches. Six researchers from Kasetsart Univ and Chulalongkorn Univ that Yamaguchi Univ has set as a priority university were invited.
Nov 18–19, 2017	Toshiharu Yakushi	The 13th Young Scientist Seminar Seminar	Yamaguchi, Yamaguchi Prefectural Seminar Park	100	This seminar was organized by graduate course students, including foreign students from Yamaguchi Univ. Students from Southeast Asia and young researchers (half of the participants were foreigners) gathered and reported on research results. In addition, there were several lectures by experienced researchers as invited talks.
March 6, 2018	Mamoru Yamada	The 14th Young Scientist Seminar Seminar	Yamaguchi, Yamaguchi University	40	This seminar was organized by graduate course students, including foreign students from Yamaguchi Univ. Students from Southeast Asia and young researchers (half of the participants were foreigners) gathered and reported on research results. In addition, there were two lectures by experienced researchers as invited speakers.
October 24, 2018	Somchanh Bounphanmy, Mamoru Yamada	e-ASIA JRP Seminar	Lao, Luangprabang	40	In the second meeting of this program, there were presentations mainly on the research results by foreign researchers. In addition, Satellite Seminar of the Core-to-Core Program was held the day before, and related researches were presented there as well.
Nov 13–14, 2018	Mamoru Yamada	The 15th Young Scientist Seminar Seminar	Yamaguchi, Yamaguchi Prefectural Seminar Park	100	This seminar was organized by graduate course students, including foreign students from Yamaguchi Univ. Students from Southeast Asia and young researchers gathered and reported on research results. In addition, there were several lectures by experienced researchers as invited talks.
Dec 2–4, 2018	Mamoru Yamada	Final Joint Seminar of Core-to-Core Program	Yamaguchi, Yamaguchi University	150	Yamaguchi Univ and universities in 5 countries as core universities held the final joint seminar of the international core program, in which the research results of this program were presented as oral and poster.
March 4, 2019	Hisashi Hoshida	10th YU-RCTMR symposium and ALCA/JST Workshop The International Symposium on Cellular Responses, Adaptation and Fermentation in Stress Environments	Yamaguchi, Yamaguchi University	50	The international symposium was held with a financial support by JST-ALCA. The symposium was organized by Thermotolerant Microbial resources Center, Yamaguchi University. Three invited speakers from Belgium, China and RIKEN, and two speakers from the center gave talks about thermotolerance, stress tolerance, high-temperature fermentation and strain development with plant and microorganisms including algae.

8 Total

Lists of Achievements and Implemented Activities

4. Record of Research Exchanges

Date of Departure	Date of Return	Last Name & First Name	Country of Affiliation	Affiliation	Position	Exchange Destination	Description of Exchange Content/Purpose	Duration of Exchange
2017/7/25	2017/7/29	Mamoru Yamada	Japan	Yamaguchi University	Professor	Thailand, Khon Kaen	Conference	5
2017/8/22	2017/8/27	Mamoru Yamada	Japan	Yamaguchi University	Professor	Thailand, Bangkok,	Symposium, Meeting	6
2017/8/25	2017/8/27	Toshiharu Yakushi	Japan	Yamaguchi University	AssociateProfessor	Thailand, Bangkok,	Symposium, Meeting	3
2017/8/25	2017/8/27	Kenji Sakai	Japan	Kyushu University	Professor	Thailand, Bangkok,	Symposium, Meeting	3
2017/8/25	2017/8/27	Izumi Kumakiri	Japan	Yamaguchi University	AssociateProfessor	Thailand, Bangkok,	Symposium, Meeting	3
2017/8/25	2017/8/27	Hisashi Hoshida	Japan	Yamaguchi University	AssociateProfessor	Thailand, Bangkok,	Symposium, Meeting	3
2017/9/3	2017/9/7	Mamoru Yamada	Japan	Yamaguchi University	Professor	Germany, Berlin,	Symposium, Meeting	5
2017/9/3	2017/9/7	Naoya Kataoka	Japan	Yamaguchi University	Assistant Professor	Germany, Berlin,	Symposium, Meeting	5
2017/9/3	2017/9/7	Kenji Sonomoto	Japan	Kyushu University	Professor	Germany, Berlin,	Symposium, Meeting	5
2017/9/3	2017/9/7	Yukihiro Tashiro	Japan	Kyushu University	AssociateProfessor	Germany, Berlin,	Symposium, Meeting	5
2018/2/26	2018/3/2	Izumi Kumakiri	Japan	Yamaguchi University	AssociateProfessor	Thailand, Nakhon	Meeting, Lecture	5
2018/2/26	2018/3/2	Naoyuki Aso	Japan	Yamaguchi University	Student	Thailand, Nakhon	Meeting	5
2018/2/26	2018/3/2	Ryutaro Kishibe	Japan	Yamaguchi University	Student	Thailand, Nakhon	Meeting	5
2018/9/25	2018/10/13	Takuya Abe	Japan	Yamaguchi University	Student	Thailand, Ubon	Joint Research	19
2018/10/22	2018/10/26	Mamoru Yamada	Japan	Yamaguchi University	Professor	Lao, Luang Prabang	Symposium, Meeting	5
2018/10/22	2018/10/26	Toshiharu Yakushi	Japan	Yamaguchi University	Professor	Lao, Luang Prabang	Symposium, Meeting	5
2018/10/22	2018/10/26	Yukihiro Tahiro	Japan	Kyushu University	AssociateProfessor	Lao, Luang Prabang	Symposium, Meeting	5
2018/10/22	2018/10/26	Izumi Kumakiri	Japan	Yamaguchi University	AssociateProfessor	Lao, Luang Prabang	Symposium, Meeting	5
2018/10/22	2018/10/26	Hisashi Hoshida	Japan	Yamaguchi University	AssociateProfessor	Lao, Luang Prabang	Symposium, Meeting	5
2019/3/17	2019/3/19	Mamoru Yamada	Japan	Yamaguchi University	Professor	Thailand, Bangkok,	Symposium, Meeting	3
2019/3/17	2019/3/19	Toshiharu Yakushi	Japan	Yamaguchi University	Professor	Thailand, Bangkok,	Symposium, Meeting	3
2017/6/1	2017/7/31	Noppon	Thailand	Kastsart University	Assistant Professor	Japan,Yamaguchi	Joint Research	61
2017/6/26	2017/8/25	Keo-Oudone	Lao	National University of Laos	Lecturer	Japan,Yamaguchi	Joint Research	61
2017/8/1	2017/8/30	Toulaphone Keokene	Lao	National University of Laos	Lecturer	Japan,Yamaguchi	Joint Research	30
2017/8/25	2017/8/27	Anton Muhibuddin	Indonesia	Brawijaya University	Assistant Professor	Thailand, Bangkok,	Symposium, Meeting	3
2017/8/25	2017/8/27	Somchanh	Lao	National University of Laos	AssociateProfessor	Thailand, Bangkok,	Symposium, Meeting	3
2017/9/3	2017/9/7	Gunjana Theeragool	Thailand	Kastsart University	AssociateProfessor	Germany, Berlin,	Symposium, Meeting	5
2017/9/3	2017/9/7	Savitree Limtong	Thailand	Kastsart University	Professor	Germany, Berlin,	Symposium, Meeting	5
2017/10/16	2017/12/15	Suprayogi	Indonesia	Brawijaya University	Lecturer	Japan,Yamaguchi	Joint Research	61
2017/10/16	2017/12/15	Jaya Mahar	Indonesia	Brawijaya University	Lecturer	Japan,Yamaguchi	Joint Research	61
2017/10/29	2017/10/31	Gunjana Theeragool	Thailand	Kastsart University	AssociateProfessor	Japan,Yamaguchi	Meeting	3
2017/12/5	2017/12/8	Anton Muhibuddin	Indonesia	Brawijaya University	Assistant Professor	Japan,Yamaguchi	Meeting	4
2018/2/11	2018/3/12	Toulaphone Keokene	Lao	National University of Laos	Lecturer	Thailand, Bangkok,	Joint Research	30
2018/3/1	2018/3/31	Keo-Oudone	Lao	National University of Laos	Lecturer	Japan,Yamaguchi	Joint Research	31
2018/4/1	2018/5/28	Keo-Oudone	Lao	National University of Laos	Lecturer	Japan,Yamaguchi	Joint Research	58
2018/7/24	2018/9/20	Toulaphone Keokene	Lao	National University of Laos	Lecturer	Japan,Yamaguchi	Joint Research	59
2018/10/22	2018/10/25	Savitree Limtong	Thailand	Kastsart University	Professor	Lao, Luang Prabang	Seminar, Meeting	4
2018/10/22	2018/10/25	Gunjana Theeragool	Thailand	Kastsart University	AssociateProfessor	Lao, Luang Prabang	Seminar, Meeting	4
2018/10/22	2018/10/25	Suprayogi	Indonesia	Brawijaya University	Lecturer	Lao, Luang Prabang	Seminar, Meeting	4
2018/11/6	2018/12/7	Suprayogi	Indonesia	Brawijaya University	Lecturer	Japan,Yamaguchi	Seminar, Meeting	32
2018/11/30	2018/12/5	Somchanh	Lao	National University of Laos	AssociateProfessor	Japan,Yamaguchi	Seminar, Meeting	6
2018/12/1	2019/1/3	Noppon	Thailand	Kastsart University	Assistant Professor	Japan,Yamaguchi	Seminar, Meeting	34
2018/12/1	2018/12/5	Savitree Limtong	Thailand	Kastsart University	Professor	Japan,Yamaguchi	Seminar, Meeting	5
2018/12/1	2018/12/5	Gunjana Theeragool	Thailand	Kastsart University	AssociateProfessor	Japan,Yamaguchi	Seminar, Meeting	5
2018/12/6	2018/12/10	Anton Muhibuddin	Indonesia	Brawijaya University	Professor	Japan,Yamaguchi	Meeting	5
2019/3/4	2019/3/31	Keo-Oudone	Lao	National University of Laos	Lecturer	Japan,Yamaguchi	Joint Research	28
2019/3/24	2019/3/30	Kiatkittipong	Thailand	Silpakorn University	Assistant Professor	Japan, Yamaguchi	Symposium, Joint Research	7
Total (Person)					47	Total (Person-day)		717

Lists of Achievements and Implemented Activities

5. Patent Applications

5. 1 Independent Applications by Single Team

Application Number	Name of Patent/Patent Name	Application Date	Patent Applicants (Fill in All Members)	Publication Number (leave blank if unpublished)	Inventor	Country of Application	Registration Number (leave blank if unregistered)	Country Name of the Team

0

Total (Number of Application)

0

Total (Number of Registration)

5. 2 Joint Applications

Application Number	Name of Patent/Patent Name	Application Date	Patent Applicants (Fill in All Members)	Publication Number (leave blank if unpublished)	Inventor	Country of Application	Registration Number (leave blank if unregistered)

0

Total (Number of Application)

0

Total (Number of Registration)

Lists of Achievements and Implemented Activities

6. Awards

Date of Award	Name of Award	Recipient	Remarks	Country Name of the Team
June 2, 2017	Research Encouragement Award, Amano Enzyme	Toshiharu Yakushi		Japan
September 11, 2017	The 26th Technical Award of the Society for Biotechnology	Kenji Sakai, Yukihiro Tashiro and others		Japan
September 11, 2017	The 25th Excellent Paper Award of the Society for Biotechnology	Kenji Sonomoto, Kenji Sakai, Yukihiro Tashiro and others		Japan
September 12, 2017	The 69th Topics Award of the Society for Biotechnology	Naoya Kataoka		Japan
October 4, 2017	Kasetsart University Award for International Publication	Gunjana Theeragool		Thailand
March 9, 2018	Kasetsart University, Faculty of Science Award for International Publication	Gunjana Theeragool		Thailand

6 Total