PROCEEDING

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APLAS BALI 2012

The 7th Asian-Pacific Landfill Symposium

Sustainable Solid Waste Management for a Better Life

October 8th - 11th, 2012

EDITORS:

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PREFACE

Solid waste has become one of the most enormous environmental issues in the current modern cities. Improper solid waste handling also vividly contributes to the climate change and its deleterious impacts to the environment. A new paradigm, such as waste generation avoidance (reuse, reduce, and recycle/3Rs), has emerged at the top hierarchy and become the state-of-the-art in the solid waste management and technology.

Asian Pacific Landfill Symposium (APLAS) is a biennial international symposium which purpose is to manage the serious wastes issues/problems of the Asian-Pacific region. The previous APLAS meetings that have been held in Fukuoka, Japan (2000), Seoul, South Korea (2002), Kitakyushu, Japan (2004), Shanghai, People Republic of China (2006), Sapporo, Japan (2008), and Seoul, South Korea (2010), have provided various sharing of knowledge and network about landfill and solid waste-related system. The APLAS-Bali 2012 in Indonesia would be the next rendezvous for landfill and solid waste system experts to brainstorm new breakthroughs for solving the current challenges in this area of knowledge. The symposium will provide an opportunity for academia, researchers, engineers, governments, non-governmental organizations, private sectors, industries, consultants, contractors, and manufacturers, to meet and perform ideas-exchanging, to learn, share and exchange about the latest developments and researches in solid waste management.

The scope of the symposium is covering all aspects of solid and hazardous waste management, technology and engineering practices. The presentation of APLAS-Bali 2012 Symposium consists of several groups of session:

- Keynote Lecture;
- Oral Presentation;
- Poster Presentation;
- Country Report: Municipal Solid Waste Management and Technology in Asian Countries; and
- Special Lecture.

Finally, I wish to express my gratitude to all participants for their cooperation and contribution, and to the various sponsors for their support to this symposium.

Enri Damanhuri
Chairperson, APLAS-Bali 2012
Professor, Faculty of Civil and Environment Engineering, ITB, Indonesia

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WELCOME ADDRESS

The earth now faces a crisis that is unprecedented in the history of mankind, including natural disasters such as earthquake and Tsunami, increased temperatures, unusual weather conditions involving floods and droughts, desertification as a result of deforestation et al. The earth may not survive without solving these problems. In these circumstances, the disastrous earthquake and Tsunami in Japan on March 11, 2011 has occurred. It left innumerable disaster waste such as debris and rubble of the smashed houses, buildings and other concrete structures, and scrapped cars and ships. First of all, on behalf of Japanese people, I would like to express our sincere gratitude to many people in the world who helped us immediately. The total quantity of the disaster waste is estimated to amount 25 million tons.

The APLAS Symposium has become a major international meeting of the Asia-Pacific region for the discussion of overall waste issues at research level. This indicates the need to expand our view of global environmental issues in relation to waste management instead of focusing on landfill alone. At the same time, the issues related to final landfill sites, which were the original theme of the APLAS Symposium, are also a hot topic of discussion. With the transition of the concept of final landfill sites, there is now a particular need for transparency in waste treatment processes from generation to landfill in order to eliminate anxiety over the construction and maintenance of final landfill sites; this means in particular the disclosure of information based on quantitative evaluation of the process and risk assessment of hazardous substances. The transparency of final landfill sites as a technical dimension to control the waste management process (improving safety) and the information disclosure as a social dimension and community development involving local residents (developing a sense of reliability and reassurance) are simultaneously important key points. The difference that should be highlighted here now is that conventional discussions on treatment facilities have revolved around the facilities themselves, whereas the concepts of “material flow and conversion” and “social systems” toward a sound material-cycle society should be included in discussions from now on. To guide overall terminal waste management systems in the right direction, it is important to establish technologies and social institutions for treating the effects of hazardous waste and recycling useful waste, leading to the regeneration and the space recovery of final landfill sites for use over a longer time frame. This means that landfilling function should be considered as one of systems for proper waste management, namely as a final proper disposal system.

I would like to express my sincere congratulations to all involved in the significant holding of the Seventh Asian-Pacific Landfill Symposium in Bali, Indonesia, and to express my sincere gratitude to many people taking part in the event from Asian Pacific nations and many countries across the world.I am also pleased to share with all participants the pleasure of this opportunity for researchers, engineers, government officials and many other specialists involved in tackling waste problems faced by Asia-Pacific countries to assemble and exchange their latest research results and experiences. I strongly believe that the outcome will help to resolve the waste problems faced by many countries in the Asian-Pacific region and around the world, as well as providing insights toward the resolution of global environmental issues. Lastly, I hope for the success of this symposium with the cooperation of all participants, and for the continued development of the APLAS Symposium in the future.

Toru Furuichi
Chairperson, APLAS-Bali 2012
President, NPO・LSA
Professor, Hokkaido University, Japan

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WELCOME ADDRESS

In the first opprotunity, I would like to convey my gratitude and welcome in the 7th Asian Pacific Landfill Symposium (APLAS) Bali 2012, which is held in Bali, on October 8th-11th, 2012. Other than Bali that has been well-recognized as one of the world class tourism destinations, Bali was chosen to host APLAS this year, due to its good performance to implement proper municipal solid waste management.

Locally, Indonesian Government puts high commitment to support a proper municipal solid waste system. Central Government has a role to regulate, monitor, and empower the capacity building of Local Governments, while Local Governments have a role to implement the municipal solid waste system in their provinces, districts, or cities. This is in line with the spirit of autonomy of Local Governments and decentralization. Thus, Central Government must stimulate the implementation and ensure the proper performance of Local Governments to achieve the determined goals in municipal solid waste sector.

In the international level, Indonesian Government has committed to reduce the greenhouse gas emission from municipal solid waste sector. This is achieved through the implementation of sanitary landfill or controlled landfill as the most common chosen technology to treat municipal solid waste in Indonesia. These technologies eliminate the uncontrolled of methane gas emission, which contributes to the global climate change. Furthermore, methane gas has calorific value that can be converted as the source of alternative and green energy.

In order to achieve proper dwellings and healthy environment in the local, regional, and global levels, Directorate General of Human Settlements Ministry of Public Works, has regulated the policy and strategy at the national level, for municipal solid waste system development. It has been legalized in the Ministry of Public Works Regulation number 21/PRT/M/2006. This policy and strategy regulates the waste minimization and reduction at the source of waste generation, thus it will further subdue the burden for storage, collection, transportation, and treatment subsystems. Other than technical and technological aspect, this legal document also states the need for organizational, regulation, community participation, and funding aspects in municipal solid waste sector.

APLAS Bali 2012 with the theme of "Sustainable Solid Waste Management for a Better Life" is expected to be an event for ideas, thought, and concept exchanging for researchers, engineers, Central/Local Governments, non governmental organizations, private companies, consultants, contractors, and manufacturers in municipal solid waste sector. It is expected that various topics are discussed in the symposium, not just landfilling technology, but also waste minimization technologies, alternative waste treatment technologies, hazardous waste treatments, waste/biomass to energy conversion technologies, municipal solid waste system in developing countries, and health impacts of waste to health and environment.

Lastly, I would like to wish you all to have a fruitful symposium. I hope that this symposium can give enormous outcomes for the development of science, technology, and sustainable development of municipal solid waste system in Indonesia.

Budi Yuwono P.
Steering Commitee, APLAS Bali 2012
Head of Indonesian Society of Sanitary and Environmental Engineers
Director General of Human Settlements, Ministry of Public Works

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OSM - Integrated of Solid Waste Management

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SYMPOSIUM AGENDA

Time	Monday, 8-Oct-12	Tuesday, 9-Oct-12		Wednesday, 10-Oct-12	Thursday, 10-Oct-12
8:00		08:00 Registration		08:00 Registration	08:00 Registration
	08:30 Registration				
9:00		09:00 Oral Presentation Session	09:00 MSWM Session	09:00 MSWM Session	
10:00		10:20 Coffee Break		10:20 Coffee Break	
		10:40 Oral Presentation Session	10:40 MSWM Session	10:40 Special Lecture 1	
11:00					
12:00		12:00 Lunch, Exhibition and Poster Session		12:10 Lunch, Exhibition and Poster Session	
	12:30 Opening Ceremony				
13:00		13:00 Oral Presentation Session	13:00 MSWM Session	13:10 Special Lecture 2	Site Visit
	13:15 Opening of Exhibition				
14:00	14:00 Plenary Lecture 1			14:30 Coffee Break	
	14:30 Plenary Lecture 2	14:40 Coffee Break		14:50 Special Lecture 3	
15:00	15:00 Plenary Lecture 3	15:00 Oral Presentation Session	15:00 MSWM Session		
	15:30 Coffee Break				
16:00	16:00 Plenary Lecture 4				
	16:30 Plenary Lecture 5				
17:00	17:00 Plenary Lecture 6				
18:00				18:30 Farewell Party (Dinner)	
19:00	19:00 Welcoming Party (Dinner)				
20:00					

Room: Wantilan Convention Center | Wantilan A, C1, C1, Jauk, Garuda | Wantilan B

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FIRST DAY*(1st Day)*: Monday, October 8th, 2012

Plenary Session

Room: Wantilan Convention Center

Time	Agenda	Moderator
08.30 - 12.30	**Registration**	
12.30 - 13.15	**Opening ceremony:** - **Organizing Committee** *(Report of committee)* - **Chairpeson of APLAS Bali 2012***(Welcoming speech)* - **Governor of Bali, Indonesia** *(Welcoming speech)* - **Representative of Ministry of Environment, Japan***(Welcoming speech)* - **Minister of Public Works, Indonesia** *(Opening remarks)*	MC
13.15 - 14.00	**Opening of exhibition: Minister of Public Works, Indonesia**	
14.00 - 14.30	**Plenary lecture 1: Mrs. Masnellyarti Hilman, Indonesia:** *Waste Management Policy in Indonesia*	Prof. Enri Damanhuri
14.30 - 15.00	**Plenary lecture 2: Dato' NadzriYahaya, PhD, Ministry of Housing and Local Government, Malaysia:** *Policy and Strategy of Solid Waste Management in Malaysia*	
15.00 - 15.30	**Plenary lecture 3: Prof. ChettiyappanVisvanathan, AIT Thailand:** *3R Pathway Towards Sustainable Landfill Management*	
15.30 - 16.00	**Coffee break**	
16.00 - 16.30	**Plenary lecture 4: Prof. Masaru Tanaka, TUES Japan:** *Promotion of 3Rs and Solid Waste Disposal*	Prof. Agamuthu Pariatamby
16.30 - 17.00	**Plenary lecture 5: Prof. Kunio Yoshikawa, TIT Japan:** *Production of Useful Fuels and Electricity from Biomass and Waste Resources*	
17.00 - 17.30	**Plenary lecture 6: Prof. Joni Hermana, ITS Indonesia:** *Landfill Leachate Handling and Treatment in Indonesia*	
19.00 - 21.00	**Dinner, Welcoming party**	

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SECOND DAY*(2nd Day)*: Tuesday, October 9th, 2012

Parallel Session

Session A – Waste Prevention Management (OWP) &Municipal Solid Waste in Developing Countries (OMS)

Room : Wantilan A

No	Time	ID no	Code	Name	Country	Title	Moderator
1	09.00-09.20	1	OWP-1	Ahmad Fariz Mohamed	Malaysia	Standard for Waste Recycling Industry in Malaysia: Towards Sustainability of Recycling Industry.	Takeshi Fujiwara
2	09.20-09.40	29	OWP-8	Sakaraia Serau	Fiji Islands	Sharing the Experience of 3R Project in Fiji	
3	09.40-10.00	75	OWP-3	Fauziah S.H.	Malaysia	Challenges of 3Rs Implementation: Public Participation towards Sustainable Waste Management in Malaysia	
	10.20-10.40	**Coffee Break**					
4	11.00-11.20	146	OWP-9	Tariq Bin Yousuf	Bangladesh	3R Action Plan: A Targeted Waste Management Solution for Bangladesh	
	12.00-13.00	**Lunch, Exhibition and Poster Session**					
5	13.00-13.20	159	OWP-5	Hossein Ganjidoust	Iran	Municipal Solid Waste Minimization Programs in Alvand, Qazvin, I.R.Iran	Agamuthu P. & Asep Sofyan
6	13.20-13.40	39	OMS-9	Siti Norbaizura Md. Rejab	Japan	Low-Carbon City 2025; Sustainable Iskandar Malaysia - from the viewpoint of Solid Waste Management	
7	13.40-14.00	58	OMS-7	Periyathamby Kuruparan	Sri Lanka	Development of Waste Segregation Scheme for Compost Processing in Ampara Urban Council in Ampara District Eastern Sri Lanka	
8	14.00-14.20	59	OMS-8	Periyathamby Kuruparan	Sri Lanka	Learning Experience of Cluster Waste Management Facilities: Karaitivu Waste Transfer Station and Addalachenai Landfill under Ampara District Eastern Sri Lanka	
9	14.20-14.40	60	OMS-5	Irwan Ridwan Rahim	Japan	Economic Incentives in an Effort to Reduce Greenhouse Gas Emissions from Municipal Solid Waste Sector (Case study in Indonesians' Major Cities)	
	14.40-15.00	**Coffee Break**					
10	15.00-15.20	79	OMS-4	Do Thi Thu Trang	Japan	Estimation of Commercial and Institutional Solid Waste Generation in Hue city, Vietnam	Kurian Joseph &Dollaris Riauaty
11	15.20-15.40	92	OMS-10	Yasuhiro Matsui	Japan	Comparison of Operational Efficiency Among Waste Collection Systems in Da Nang City, Vietnam	
12	15.40-16.00	95	OMS-6	Naofumi Sato	Japan	Current Condition and Issues of Municipal Solid Waste Management in Sri Lanka	
13	16.00-16.20	127	OMS-1	D.M.C.B. Wijerathna	Sri Lanka	Solid Waste Management Issues in Developing World – A case study from Sri Lanka	
14	16.20-16.40	155	OMS-3	Dian Marya Novita	Indonesia	Heating Value Based on Composition and Characteristics of Municipal Solid Waste in Indonesia in Waste to Energy Concept	

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SECOND DAY*(2nd Day)*: Tuesday, October 9th, 2012

Parallel Session

Session B – Waste Biomass Utilization (OWB) &Waste Proccessing and Treatment (OWT)

Room : Wantilan C1

No	Time	ID	Code	Name	Country	Title	Moderator
1	09.00-09.20	7	OWB-8	Sandhi Eko Bramono	Indonesia	Anaerobic Fermentation of Food Waste to Biosolvents by Clostridium species	Suryaman Shakya
2	09.20-09.40	22	OWB-7	Osamu Sawai	Japan	Supercritical Water Gasification of Sewage Sludge Using Bench-Scale Reactor: Study on the Behavior of Metals and Nutrients	
3	09.40-10.00						
	10.20-10.40	**Coffee Break**					
4	10.40-11.00	46	OWB-5	Kyuyeon Kim	Korea	Waste Stream Analysis and Energy Recovery Plan on Organic Sewage Sludge in Korea	Joni Hermana
5	11.00-11.20	115	OWB-10	Wahyono Hadi	Indonesia	Solid Waste Biorafinery	
6	11.20-11.40	157	OWB-4	Jae Sung Park	Korea	Biomass Contents and its Effect Factors of SRF in Korea	
7	11.40-12.00	122	OWB-2	Emenda Sembiring	Indonesia	The Important of Germination Index for Compost Application to Enhance a Plant Growth	
	12.00-13.00	**Lunch, Exhibition and Poster Session**					
8	13.00-13.20	165	OWB-9	Seno Darmawan Panjaitan	Indonesia	Potency of Biogas from Municipal Solid Waste for Electricity Generation: Case Study of a Small Scale Landfill in Pontianak	Tariq Bin Yousuf & Alex Chalik
9	13.20-13.40	166	OWB-6	Ni Luh Putu Sari Udyani	Indonesia	C-Organic Degradation on Preliminary Study of Potential Composting of Sludge Produce Water from Oil and Gas Industry	
10	13.40-14.00	23	OWT-2	Bijan Bina	Iran	Evaluation of Stability Parameters in In-Vessel Composting of Municipal Solid Waste	
11	14.00-14.20	33	OWT-6	S.S.R.M.D.H.R. Wijesekara	Sri Lanka	Application of Nano-Zero Valent Iron for Landfill Leachate Treatment in The Tropics	
12	14.20-14.40	34	OWT-7	Sonia S.Mayakaduwa	Sri Lanka	Characterization of Leachate Draining From Gohagoda Landfill for Dissolved Organic Carbon, Nutrients and Heavy Metals	
	14.40-15.00	**Coffee Break**					
13	15.00-15.20	35	OWT-1	Ari Rahman	Japan	Thermodynamic Simulation of Textile Sewage Sludge Combustion	Mitsuo Kawaguchi &Emenda Sembiring
14	15.20-15.40	44	OWT-4	Mohajit	Indonesia	Financial Prospect to The Application of Decanter System for The Treatment of Sludge Waste in Water Treatment Plant System	
15	15.40-16.00	135	OWT-5	Pham T.H.D.	Vietnam	Numerical Hydrodynamic of Liquid and Solid Phase in Moving Bed Biofilm Reactor to Removal Nitrogen	
16	16.00-16.20	161	OWT-9	Yong-Chil Seo	South Korea	Application of Oxy-Combustion To Waste Sludge As A Carbon Capture and Storage Technology	
17	16.20-16.40	28	OWT-8	Shunsuke Kashiwakura	Japan	Rapid Quantification of Manganese in Steel Scraps by Laser-Induced Plasma Spectroscopy under Atmospheric Pressure	
18	16.40-17.00	164	OWT-3	Elisabeth Leonora	Indonesia	Study of Coagulation and Flocculation Process in Leachate Treatment	

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SECOND DAY*(2nd Day)*: Tuesday, October 9th, 2012

Parallel Session

Session C – Integrated Solid Waste Management (OSM)

Room : Wantilan C2

No	Time	ID	Code	Name	Country	Title	Moderator
1	09.00 -09.20	27	OSM-11	Yoshinori Ito	Japan	Empirical Study About The Waste Environmental Measure and Corporate Value in Japanese Companies	Kati Andraini
2	09.20-09.40	53	OSM-3	Dennis Victor	Malaysia	Strategic Environmental Assessment Policy Intervention Scenario For Solid Waste Management In Malaysia	
3	09.40-10.00	87	OSM-10	Yong-Chul Jang	South Korea	Current Practices and Challenges of Municipal Solid Waste Management toward a Sustainable Society in Korea	
4	10.00-10.20	88	OSM-9	Sithamparanathan Sivakumaran	Sri Lanka	Integrated Solid Waste Management System Implementation In Ampara District, Sri Lanka	
	10.20-10.40	**Coffee Break**					
5	10.40-11.00	119	OSM-12	Yu-Chi Weng	Japan	Proposal of Estimation Model for the Destruction Quantity of the Building Stock Considering the Regional Characteristics and its Application to the Regional Rehabilitation Plan-Learned from the Lesson of the Great East Japan Earthquake	Mohammad Helmy
6	11.00-11.20	120	OSM-13	Yu-Chi Weng	Japan	Study of Reduction of Final Disposal Amount and GHG Emission by Waste Management Strategy for the Municipalities without Incinerators - Effectiveness of Recycling by Improved Separation of Kitchen Waste, Papers, and Plastics in Kitahiroshima City	
7	11.20-11.40	133	OSM-5	Kazuei Ishii	Japan	A New Concept of Final Disposal Systems for MSW Management Considering Storage of Recyclable Materials and Disaster Waste	
8	11.40-12.00	141	OSM-2	Dena Sismaraini	Indonesia	Waste Characteristic Suitability in Bogor Regency as Alternative Fuels and Raw Materials in Cement Industry	
	12.00-13.00	**Lunch, Exhibition and Poster Session**					
9	13.00-13.20	81	OSM-7	Margarettha Christine Siregar	Indonesia	Bank Sampah Wahana Bersama: Understanding Community's Attitude towards The Role of The Informal Sector in Solid Waste Management in Pontianak.	Ben Basnayake &Djoko Heru
10	13.20-13.40	100	OSM-8	Mochammad Chaerul	Indonesia	Evaluation and Improvement of Solid Waste Management at Traditional Market (Case Study: Ujung Berung Traditional Market in Bandung City)	
11	13.40-14.00	125	OSM -1	Asep Sofyan	Indonesia	Greenhouse Gas Mitigation Scenario for Solid Waste in Indonesia	
12	14.20-14.40	73	OSM-4	Haryo Tomo	Austria	Combinatorial and Pinch Analysis for Minimizing Generated-Air Pollution from Solid-waste Treatment Area	
	14.40-15.00	**Coffee Break**					

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SECOND DAY*(2nd Day)*: Tuesday, October 9th, 2012

Parallel Session

Session D – Hazardous Waste Management (OHW) &Health and Environment Aspect of Solid Waste Handling (OHE)

Room : Jauk Room

No	Time	ID	Code	Name	Country	Title	Moderator
1	09.00 -09.20	43	OHW-2	Sithamparanathan Sivakumaran	Sri Lanka	Evaluation of Clinical Waste Disposal Practices of Hospitals In Ampara District	Orawan Siriratpiriya
2	09.20-09.40	89	OHW-3	Widi Astuti	Indonesia	Public Perception Study and Influential Factors of Electronic Waste (E Waste) in Semarang City	
3	09.40-10.00	130	OHW-6	Zeneth Ayesha Thobarony	Indonesia	Characteristic and Potential of Toxic Waste From Assembly Process in Automobile Industry (Case Study: Industry X)	
	10.20-10.40	**Coffee Break**					
4	10.40-11.0	163	OHW-1	Asri Cipta Indah Oktaviana	Indonesia	Identification of Informal Integrated Circuit Recycler and Collector as a Basis for Material Flow Analysis of Integrated Circuit in Bandung	Yong-Chil Seo
5	11.00-11.20	86	OHW-4	Yong-Chul Jang	South Korea	A Roadmap of Waste Electrical and Electronic Equipment(WEEE) Recycling Technology Development in Korea	
6	11.20-11.40	42	OHE- 6	Sunarto	Indonesia	The Role of Waste Processing at TPS on The Reducing of Carbon Footprint of Waste Management in Malang	
7	11.40-12.00	118	OHE- 2	Kyeong-ho Lee	Korea	An Assessment Study on The Potential Application of Solidified Sludge As Landfill Cover by Using of Odor Index Species	
	12.00-13.00	**Lunch, Exhibition and Poster Session**					
8	13.00-13.20	121	OHE -1	Emenike C.U.	Malaysia	Leachate Risk: Bioaccumulation of Heavy Metals in Fish	Made Sudiana Mahendra &Jaehyuk Hyun
9	13.20-13.40	70	OHE -3	Nguyen Phuc Than	Japan	Potential on GHG Mitigation of Municipal Solid Waste Treatment Alternatives in Vietnam	
10	13.40-14.00	124	OHE -4	Ramrav Hem	Japan	Three-Dimensional Analysis of Groundwater Contaminated by 1,4-Dioxane at An Illegal Dumping Site with Complex Hydrogeological Features	
11	14.00-14.20	158	OHE-5	Samaneh Pasha Zanousi	Iran	Evaluation of Sludge Reduction in WWTPs by Aquatic Tubifex	
	14.40-15.00	**Coffee Break**					

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SECOND DAY*(2nd Day)*: Tuesday, October 9th, 2012

Parallel Session

Session E – Sustainable Landfilling Sitting Process (OSL)

Room : Garuda Room

No	Time	ID	Code	Name	Country	Title	Moderator
1	09.00 -09.20	5	OSL-6	Kent P. von Maubeuge	Germany	Advantages of Geosynthetics over Natural Materials in Composite Liner Systems	Benno Rahardya
2	09.20-09.40	9	OSL-5	Kasam	Indonesia	Effect of Age of Municipal Solid Waste on Quantity And Quality of leachate Landfill Generation By Column-Experiment	
3	09.40-10.00	6	OSL-7	Kent P. von Maubeuge	Germany	The New Generation of Geosynthetic Clay Liners	
4	10.00-10.20	18	OSL-2	Dongbei Yue	China	Effectiveness of Aerobic Pretreatment of Municipal Solid Waste for Reduction of Non-methane Organic Compounds during Simulated Landfilling	
	10.20-10.40	**Coffee Break**					
5	10.40-11.00	25	OSL-11	Pham T.H.D.	Belgium	N removal Modelisation in a Moving Bed Bio-film Reactor (MBBR) with a Modified ASM3 Model	Haryo Satryo Tomo
6	11.00-11.20	30	OSL-1	Alice Leney	New Zealand	Landfill Construction and Leachate Management for Low-lying Coral Atolls	
7	11.20-11.40	38	OSL-16	Takashi Miyagawa	Japan	Improvement of An Existing Open Dumping Site by Fukuoka Method through JICA Training Follow-up Program	
8	11.40-12.00	142	OSL-17	Tri Padmi/ Sandia	Indonesia	Identification of Bacteria Communities That Play Role on Methane Oxidation In Landfill Cover Material	
	12.00-13.00	**Lunch, Exhibition and Poster Session**					
9	13.00-13.20	52	OSL-12	R.T.K. Ariyawansha	Sri Lanka	Inferences Drawn from Converting a Dumpsite Quarry to a Sustainable Landfill in the East Coast of Sri Lanka	Chettiyappan Visvanathan
10	13.20-13.40	65	OSL-18	Tri Budi Prayogo	Japan	The Effect of Water Content of Waste Material on Gas Generation	
11	13.40-14.00	94	OSL-3	Gemunu Herath	Srilanka	Characterizing Solid Waste at Dumps in Different Geographical Settings of Sri Lanka for Potential Energy Generation	
	14.40-15.00	**Coffee Break**					
14	15.00-15.20	156	OSL-19	Widodo Brontowiyono	Indonesia	The Role of Community Solid Waste Management towards Sustainable Final Disposal Site (TPA) Piyungan, Yogyakarta	Ariani Dwi Astuti and Asep Sofyan
15	15.20-15.40	143	OSL-8	M. Saravanan	Malaysia	Landfill Liner Interface Parameters And Member Selection With Stability Assessment, And Factor Of Safety Predictions With Seismic Loading	
16	15.40-16.00	162	OSL-15	Sri Darwati	Indonesia	Developing A Block Landfill Concept for Sustainable Solid Waste Management at Final Processing Site	
17	16.00-16.20	149	OSL-10	Opy Kurniasari	Indonesia	Performance Methan Oxidation in Lisimeter Using Compost Landfill Mining As Biocover to Reduce Methane Gas Emissions from Landfills	
18	16.20-16.40	3	OSL-13	Ruslan Ramang	Indonesia	Effects of Problems and Waste Handling on The Community Participation in Waste Management (a Case Study in The Urban Cimahi)	
19	16.40-17.00	129	OSL-14	Samin	Indonesia	The Determination of Leachate Generation Using a modified Thornthwaite method	

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SECOND DAY*(2nd Day)*: Tuesday, October 9th, 2012

MSWM Session

Municipal Solid Waste Management and Technology in Asian Country
Country Report and Best Practices
Room: Wantilan B

Time	Agenda	Moderator
08.00 - 09.00	**Registration**	
09.00 - 10.20	**- Indonesia: M. SjukrulAmien** **- Bangladesh: Tariq Bin Yousuf** **- Cambodia: Sour Sethi**	Masaru Tanaka
10.20 - 10.40	**Coffee break**	
10.40 - 12.00	**- India: Kurian Joseph** **- Japan: Takeshi Fujiwara** **- Indonesia: Anita Firmanti Eko Susetyowati**	Chettiyappan Visvanathan
12.00 - 13.00	**Lunch, Exhibition and Poster Session**	
13.00 - 14.40	**- Nepal: Suryaman Shakya** **- Singapore: OngSengEng** **- Thailand: Orawan Siriratpiriya** **- Indonesia: H. Rendra Kresna**	Kunio Yoshikawa & Aboejoewono Aboeprayitno
14.40 - 15.00	**Coffee break**	
15.00 - 16.40	**- Malaysia: Agamutu Pariatamby** **- Srilanka: Ben Basnayake** **- South Korea: Jaehyuk Hyun** **- Cynthia Hendrayani (PT. NOEI)**	Joni Hermana & Mohammad Helmy

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THIRD DAY*(3rd Day)*: Wednesday, October 10th, 2012

MSWM and Special Lecture Sessions

Municipal Solid Waste Management and Technology in Asian Country
Country Report and Best Practices

Room: Wantilan Convention Center

MSWM Session			
Time		Agenda	Moderator
08.00 - 09.00		**Registration**	
09.00 - 10.20		- **China: Kaimin Shih** - **Indonesia: Tri Rismaharini** - **Vietnam: Ngo Kim Chi** - **Indonesia: Jos Rizal**	Kati Andraini
10.20 - 10.40		**Coffee break**	
Special Lecture Session			
10.40 - 12.10		**Special Lecture 1:** - **Yoichi Toyama (MoE Japan):** *Waste Management Administration in Japan, History of Waste Management in Japan and Recent Activities on 3Rs Inside and Outside Japan* - **Mitsuo Kawaguchi (LSA, Japan):** *History and Regulation of Waste Landfilling in Japan* - **SugiantoTandio (PT. Tirta Marta):***Are you a ZEROnaut? (Plastic's Problems, Trends, Myths & the ZEROnaut Solution)*	Ben Basnayake
12.10 - 13.10		**Lunch, Exihibition, and Poster Session**	
13.10 - 14.30		**Special Lecture 2:** - **David Kuper (Temesi Recycling Facility, Indonesia):** *Avoidance of Methane Production from MSW Decay through Composting (CDM TPST project) at Temesi (Gianyar), Bali* - **Jan Theulen (Heidelberg Cement, Germany):***Economical and Resource Efficient Recovery of MSW in Cement Kilns* - **ByungChul Shin (SLC, Korea):** *Introduction to SLC and its Overseas Activities*	Susmono
14.30 - 14.50		**Coffee Break**	
14.50 - 16.50		**Special Lecture 3:** - **JohanesJager (TU Darmstadt, Germany):** *Landfill Reconstruction for Sustainability* - **Tariq Bin Yousuf (Dhaka North City Corporation, Bangladesh):** *Semi-aerobic Landfill at Dhaka Final Disposal* - **Budi S. Prasetyo (PT. Karya PrimaAnugerahMandiri, Indonesia):** *State of the Art Geosynthetic for Landfill Engineering Application* - **Christopher Godlove (Global Methane Initiative, US-EPA):** *Global Methane Initiative in Asia*	Nugroho Tri Utomo &Alex Chalik
18.30 - 20.30		**Dinner and Farewell Party**	

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FOURTH DAY*(4th Day)*: Thursday, October 11th, 2012

Site Visit Agenda

Time	Agenda
08.00 – 08.30	Registration
08.30 – 08.45	Trip to TPA (Landfill) Suwung (Denpasar City)
08.45 – 10.30	Field Visit at TPA (Landfill) Suwung
10.30 – 12.00	Trip to Bebek Bengil
12.00 – 13.00	Lunch
13.00 – 13.45	Trip to TPA (Landfill) Temesi (Gianyar District)
13.45 – 15.30	Field Visit at TPA (Landfill) Temesi
15.30 – 17.00	Trip to Garuda Wisnu Kencana
17.00 – 18.30	Tour Visit at Garuda Wisnu Kencana
18.30 – 19.00	Trip to Jimbaran
19.00 – 20.00	Dinner
20.00 – 20.45	Back to Aerowisata Sanur Beach Hotel

The 7th Asian Pacific Landfill Symposium
October 8th - 11th, 2012, Bali, Indonesia
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ID 142

Identification of Bacteria Communities that Play Role of Methane Oxidation inside Potential Landfill Cover Material (Biocover)

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ABSTRACT

Landfill plays a role as important source of methane as green house gas. Several researches were conducted to reduce methane emission from landfill; one of them was a low cost approach which used cover layer material from composting called biocover. Microbial activity was designed inside column reactor as its natural habits in landfill. Characterization of isolated indigenous bacteria was needed to enhance its potential inside biocover. Three different bacteria were isolated and identified using the sequencing of 16S rRNA genes. A phylogenetic tree of the 16S rRNA was built to compare with methylotrophic (bacteria that utilize methane and/ or methanol as carbon source) using neighbor-joining and bootstrapping method. The first isolate (SP1) has 99.68% similarity with Methyloversatilis universalis and 99.58% similarity with uncultured bacterium clone EDW07B001. Isolate SP1 could reduce methanol up to 1.0% (v/v), reduced nitrate as nitrogen source, reached highest growth rate (μ) of 0.0681 day^{-1}, reduced methanol up to 68.57%, VSS of 1620 mg/ L, and yield coefficient (Y) of 0.945. The second isolate (SP2) has 95.82% similarity with Hyphomicrobium vulgare. Isolate SP2 could reduce methanol up to 1.0% (v/v), reduced nitrate, reached highest growth rate (μ) of 0.0551 day^{-1}, reduced methanol up to 51.43%, VSS of 1240 mg/ L, and yield coefficient (Y) of 0.964. The third isolate (SP3) has 99.32% similarity with uncultured bacterium clone NCD938F06C1 and 99.24% similarity with Methylobacterium lusitanum. Isolate SP3 could reduce methanol up to 1.0% (v/v), reduced ammonium and nitrate, reached highest growth rate (μ) of 0.0798 day^{-1}, reduced methanol up to 51.43%, VSS of 1150 mg/ L, and yield coefficient (Y) of 0.894.

Keywords: biocover, compost, landfill, methane, methanol, methylotrophic bacteria.

1. INTRODUCTION

Nowadays, at landfill sites, waste containing organic matters is dumped, and landfill gas (LFG) such as methane (CH_4) and CO_2, are emitted by microbial degradation of organic matters. CH_4 as the second most important green house gases after CO_2, is 23 times more effective at trapping heat than CO_2 (IPCC, 2001). The atmospheric CH_4 concentration has increased by 143% over the last 250 years, largely due to increasing emissions from anthropogenic sources (US EPA, 2006). Landfills are the largest single anthropogenic source of US CH_4 emissions (US EPA, 2007).

The production of LFG will continue until the majority of the organic material in the waste has been degraded, which can take several decades. Both CH_4 and CO_2 are classified as greenhouse gases (i.e. gases that have a high capacity of absorbing infrared radiation reflected from the earth's surface).

LFG such as CH_4, which is a greenhouse effect gas and a toxicant, is preferably removed from the gas before released to the air. To study the clean-up LFG, this research is developed by using biologically active top cover to oxidize CH_4 components to CO_2 gas in landfill lysimeter. Compost from landfill disposal is used as cover material in lysimeter.

Landfill biocover such as compost is known contain microorganisms of bacteria methanotrophic, the bacteria that use methane gas for a living. Many methods of identification are now made to isolate bacteria that oxidize methane gas potential. Stresse and Stegmann (2003, in Mor *et al.*, 2006) explained that the use of compost as biofilter material for microorganisms can enhance the degradation of methane gas. From a variety of existing research, proving the presence or absence of methanotrophic of bacteria in the soil cover was not easy.

The presence of some methylotrophic bacteria inside landfill covers material from solid waste dumped site showed high potency for finding new microorganisms from this compost sample. However, current screening isolation method using synthetic media was difficult to confirm methylotrophic and methanotrophic microbial diversity inside soil sample because methanotrophic bacteria were difficult to grow in synthetic media (Murell *et al.*, 1998). Therefore, molecular biological techniques application was suitable for understanding the communities and their interaction in methane oxidation process. The methylotrophic and/or methanothropic bacteria which played role in methane oxidation pathway through methanol utilization were studied.

2. MATERIALS AND METHODS

Materials

Soil sample from Jelekong Landfill that was mined under 1 m, called as compost landfill mining, was adapted inside continuous flow reactor (Kurniasari *et al.*, 2011).

AMS (Ammonium Mineral Salt) and NMS (Nitrate Mineral Salt) was used as media specific for this research (Atlas, 1993 and Whittenbury *et al.*, 1970). 0.5% (v/v) of methane or methanol was used for carbon source (Whittenbury *et al.*, 1970).

Sample Characterization

Sample compost landfill mining was characterized before it was adapted for 3 months inside methane-reactor continuous flow as could be seen in Figure 1 (Kurniasari *et al.*, 2011). The highest bacterial point sampling was taken for physic and chemical characterization.

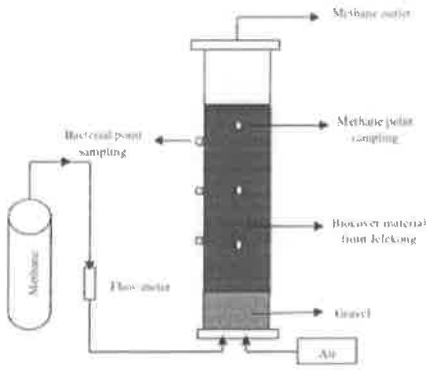

Figure 1 Reactor continuous flow (Kurniasari *et al.*, 2011)

Screening Isolation of Methanotrophic/ Methylotrophic

One gram sample was inoculated inside media AMS and NMS with methane as carbon source with several volume levels. After it was incubated for 1 week, sample was transferred to media AMS and NMS with several volume levels of methanol; as seen on Figure 2. Subculture was conducted for several times until obtained pure isolation.

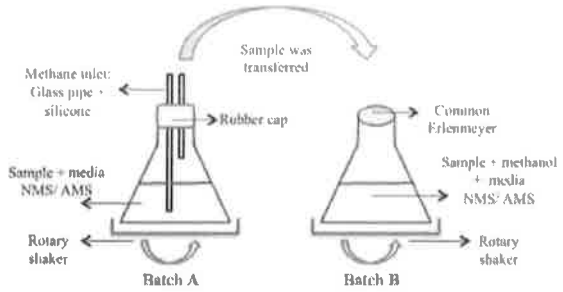

Figure 2 Batch reactors for bacterial isolation

Identification of Methanotrophic/Methylotrophic Bacteria

In this step, DNA genome from pure bacterial colony in the previous steps was isolated with Ultra Clean™ Soil DNA Isolation Kit. Subsequently, 16S rRNA gene was amplified with Polymerase Chain Reaction thermal cycler using a bacterium specific forward primer (B27f, 5'-AGAGTTTGATCCTGGCTCAG-3') and a universal reverse primer (U1492r, 5'-GGTTACCTTGTTACGACTT-3') (Lane, 1991). The PCR product was then purified, sequenced, and analyzed for constructing phylogenetic tree by using sequences of the reference organisms from NCBI (National Centre for Biotechnology Information) and programme MEGA 4.0 (Molecular Evolutionary Genetic Analysis). Certain species would be obtained according to similarity percentage from phylogenetic tree.

Bacterial Screening: Methanol and Nitrogen Source Utilization

All of isolated bacteria from previous step were inoculated inside media AMS and NMS with several levels methanol concentration (0.5%, 0.75%, and 1.0% (v/v)). Bacteria were also tested in several selective media to see their ability as bacteria which was played role in nitrogen cycle. The nitrogen is ammonium, nitrite, and nitrate.

Measurement Bacterial Growth Rate and Substrate Utilization

All of screened bacteria inoculated 10% (v/v) into media AMS or NMS, as it specific previous isolation media, with methanol as carbon source (25°C, 120 rpm). For every 2-3 days, sample was taken for counting bacteria cell and methanol reduction. The bacterial growth curve, methanol utilizing curve, and bacteria yield was measured.

3. RESULTS AND DISCUSSION

Sample Characterization

Soil sample contained 55.77% of sand, 32.38% of silt, and 3.02% of clay. This sandy loam sample, has adequate porosity (n=0.67) for methane, oxygen, and water exchange. It also has pH balance and adequate organic composition that for supporting microbial activity and methane oxidation.

Identification of Isolate SP1

Figure 3 showed that SP1 had 99.68% similarity with *Methyloversatilis universalis*. *M. universalis* was methylotrophic bacteria that used methanol (Kalyuzhnaya *et al.*, 2006). Isolate SP1 was not closely affiliated with reference methanotrophic species genetically. It also could observe that Isolate SP1 had close relationship with uncultured bacteria such as uncultured bacterium clone EDW07B001 with 99.58% similarity.

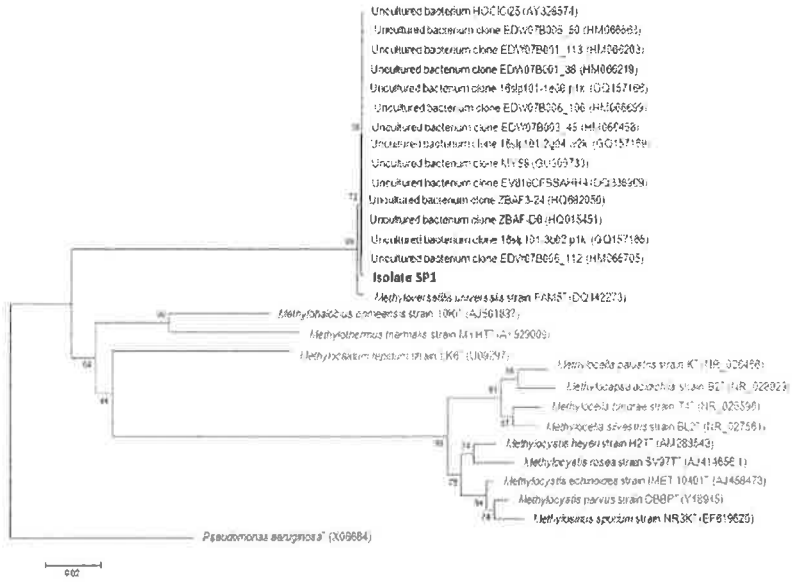

Figure 3 Phylogenetic tree of isolate SP1

Isolate SP1 had ability to reduce nitrate. However, the closest reference of Isolate SP1 c.q. *M. universalis* could not reduce nitrate (Kalyuzhnaya *et al.*, 2006). Therefore, further analysis on genotype and fenotype data should be accomplished. Besides Isolate SP1 also had high similarity with uncultured bacteria that couldn't cultivate from synthetic media.

Identification of Isolate SP2

Besides, we also have identified another isolate named Isolate SP2. As shown in Figure 4, Isolate SP2 had 95.82% similarity with *Hyphomicrobium vulgare*. This bacteria group was methylotrophic and nitrate utilizing-bacteria. Moreover, these bacteria also had slow growth rate and ability to survive in limited nutrition condition (Attwood and Harder, 1972). It could be analyzed that these bacteria could perform optimally in the end of methane oxidation pathway if there is only small amount of methanol.

Identification of Isolate SP3

Figure 5 shows affiliation of another isolated bacteria c.q. Isolate SP3 to the closest references. Isolate SP3 had 99.32% similarity with uncultured bacterium clone NCD938F06C1 and 99.24% similarity with *Methylobacterium lusitanum*. Methylobacter group has limited ability in utilizing carbon source and energy, both methanol and/or methane (Aken *et al.*, 2004). Its close similarity with uncultured bacteria in synthetic media showed there was a certain amount of methylotrophic and methanotrophic microbes inside biocover that was difficult to be cultivated. Another molecular method was indeed required to understand these communities.

The presence of some methylotrophic bacteria inside landfill covers material from Jelekong Final Disposal Site, showed high potency for finding new microorganisms from this composting sample. However, current screening isolation method using synthetic media was difficult to confirm methylotrophic and methanotrophic microbial diversity inside soil sample because methanotrophic bacteria were difficult to grow in synthetic media (Murell *et al.*, 1998). Therefore, molecular biological techniques application was suitable for understanding the communities and their interaction in methane oxidation process.

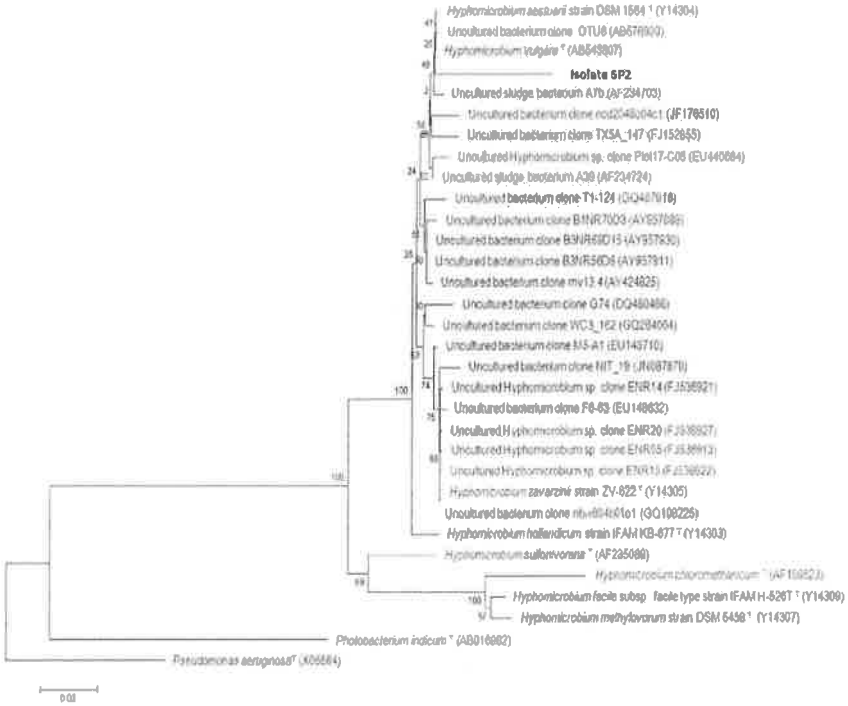

Figure 4 Phylogenetic tree of isolate SP2

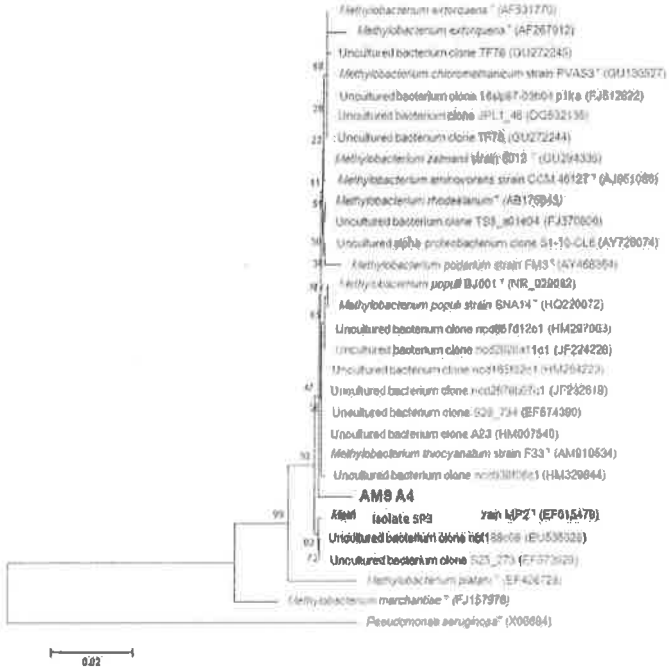

Figure 5 Phylogenetic tree of isolate SP3

Growth Curve and Substrate Utilizing of Isolate SP1, SP2, and SP3

Isolate SP1 was reached the highest growth rate (μ) of 0.0681/day and reduced methanol (as COD) up to 68.57% from 2,500 mg O_2/L until 785.71 mg O_2/L (Figure 6). Based on VSS measurement from 1,620 mg/L of Isolate SP1, it resulted on yield coefficient (Y) of 0.945. Isolate SP1 could reduce methanol up to 1.0% (v/v) and reduced nitrate as nitrogen source better than any nitrogen source, even it isolated from AMS media.

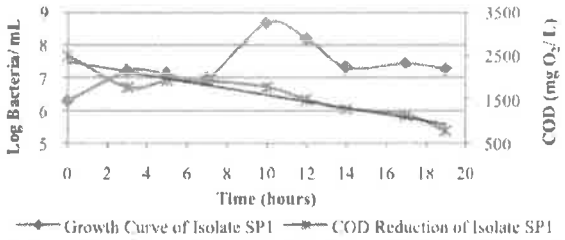

Figure 6 Growth curve and COD reduction of isolate SP1 inside AMS

Besides, Isolate SP2 was reached the highest growth rate (μ) of 0.0551/day and reduced methanol (as COD) up to 51.43% from 2,500 mg O_2/ L until 1,214.29 mg O_2/ L (Figure 7). It also had 1,240 mg/ L of VSS and 0.964 of yield coefficient (Y). It could reduce methanol up to 1.0% (v/v) and reduced nitrate well.

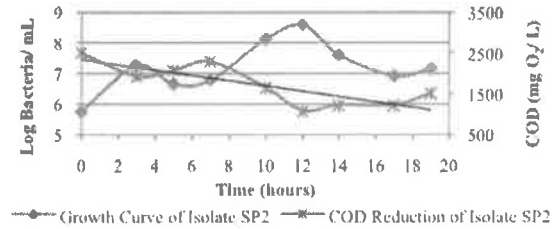

Figure 7 Growth curve and COD reduction of isolate SP2 inside NMS

Furthermore, Isolate SP3 (Figure 8) was reached the highest growth rate (μ) of 0.0798/day and reduced methanol up to 51.43% from 2,500 mg O_2/ L until 1,214.29 mg O_2/L in COD basis. It also had 1,150 mg/ L of VSS and 0.894 of yield coefficient (Y). This culture could reduce methanol up to 1.0% (v/v) and had ability to reduce ammonium and nitrate.

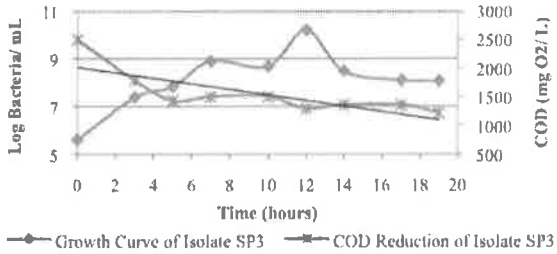

Figure 8 Growth curve and COD reduction of isolate SP3 inside AMS

4. CONCLUSION

Based on this research, we have successfully identified three methylotrophic and/or methanothropic bacteria which played role in methane oxidation pathway through methanol

utilization. These were Isolate SP1 which had 99.68% similarity with *Methyloversatilis universalis* and 99.58% similarity with uncultured bacterium clone EDW07B001; Isolate SP2 which had 95.82% similarity with *Hyphomicrobium vulgare*; and Isolate SP3 which had 99.32% similarity with uncultured bacterium clone NCD938F06C1 and 99.24% similarity with *Methylobacterium lusitanum*.

5. ACKNOWLEDGMENTS

This research was supported by SRANAS (DIPA ITB) Research Grant year 2010.

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