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5th REGIONAL CONFERENCE ON GLOBAL ENVIRONMENT

"TOWARD A SUSTAINABLE ASEAN"

21 - 22 November 2012 | Aston Tropicana Hotel, Bandung, Indonesia

PROCEEDINGS

ORGANIZED BY:

AUN/SEED-Net JICA

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Proceedings of
The 5th AUN/SEED-Net Regional Conference on Global Environment

"Toward a Sustainable ASEAN"

21-22 November 2012

Aston Tropicana Hotel

Bandung, Indonesia

Centre for Environmental Studies – Institut Teknologi Bandung
Jalan Sangkuriang No. 42 A
Bandung 40135
Jawa Barat - Indonesia

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FOREWORD

The seminar is strategic and prospective efforts to publish scholarly experimental works produced by researchers from universities, research institutions, industries, and other institutions. As part of the cutting edge research activities, seminar has been proven to play an important role in giving significant contribution to the researchers, creating discussion and providing an exchange of experience, as well as bridging the further collaboration among participants. The seminar is also an instrument in guiding the development of science and technology from the continuously research activities. In the international community windows, the seminar also reflects human dignity that demonstrates knowledge and technology.

Realizing the importance and benefits of the seminar, the Center for Environmental Studies (PSLH) Institut Teknologi Bandung (ITB) in collaboration with the College of Engineering University of the Phillippines-Diliman, which is also supported by AUN / SEED-Net, will host 5th Regional Conference on Global Environment (RCGE) on the theme "Toward a Sustainable ASEAN". The seminar will be held for two days from 21 to 22 November 2012, consisting of RCGE seminars and meetings of delegates of AUN/SEED-Net. In this conference, four plenary lectures will be given by eminent professor: Prof. Mitsuru Osaki, Director, Sustainability Governance Project (SGP), Hokkaido University; Prof. Yasushi Kiyoki, Faculty of Environment and Information Studies, Keio University; Prof. Naoyuki Funamizu, Graduate School of Engineering, Hokaido University; and Assoc. Prof. Shinjiro Kanae, Env. and Water Res. Eng. Group, Tokyo Institute of Technology, which will be continued by presentation of five invited speakers and parallel sessions. In total, we present 94 papers, which come from various countries in ASEAN. This book is a result of scientific and communicative papers compilation, which is presented in 5th Regional Conference on Global Environment (RCGE) on November 21-22, 2012, in Bandung, Indonesia.

Hopefully this conference would become a means of intensive communication between the community in pursuing the global environment in Indonesia and abroad, as well as industry and government, and could open up opportunities for cooperation for mutual benefit.

Last but not least, we gratefully acknowledge all participants, AUN/SEED-Net, and sponsors for their valuable contribution.

Bandung, 15 November 2012

Tjandra Setiadi
Head
Centre for Environmental Studies, Institut Teknologi Bandung

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CONFERENCE PROGRAM

20 November 2012	
18.00 - 20.00	Early Registration (at Hotel Aston Tropicana)

Day 1, 21 November 2012					
07.00 - 08.30	**Registration**				
08.30 - 09.00	**Opening Ceremonies and Performance** Assoc. Prof. Dr. Yogi Wibisono Budhi Chairman of The 5th AUN/SEED-Net Regional Conference on Global Environment Organizing Committee Mr. Toshiyuki Okui AUN/SEED-Net Representative Prof. Dr. Wawan Gunawan A. Kadir, MS Vice Rector for Research and Innovation Institut Teknologi Bandung, Indonesia				
09.00 - 09.30	**Plenary Lecture 1** Prof. Mitsuru Osaki Director of Sustainability Governance Project, Hokkaido University, Japan Theme: Carbon Management in Peat Forest				
09.30 - 10.00	**Plenary Lecture 2** Assoc. Prof. Shinjiro Kanae Env. And Water Res. Eng. Group, Tokyo Institute of Technology, Japan Theme: Global Hydrology and Climate Change				
10.00 - 10.30	**Photo Session and Coffee Break**				
10.30 - 12.05	**Parallel Session I**				
	Room 1	**Room 2**	**Room 3**	**Room 4**	**Room 5**
10.30 - 10.50	WP-1	PW-1	SC-1	AP*	CC-1
10.50 - 11.05	WP-2	PW-2	SC-2	AP-1	CC-2
11.05 - 11.20	WP-3	WP-6	SC-3	AP-2	CC-3
11.20 - 11.35	WP-4	WP-7	SC-4	AP-3	CC-4
11.35 - 11.50	WP-5	WP-8	SC-5	AP-4	CC-5
11.50 - 12.05	Question & Answer Session				
12.05 - 13.05	**Lunch**				
13.05 - 14.20	**Parallel Session II**				
	Room 1	**Room 2**	**Room 3**	**Room 4**	**Room 5**
13.05 - 13.20	WP-9	PW-3	SC-6	AP-5	CC-6
13.20 - 13.35	WP-10	PW-4	SW-1	AP-6	CC-7
13.35 - 13.50	WP-11	WP-14	SW-2	WP-17	CC-8
13.50 - 14.05	WP-12	WP-15	SW-3	WP-18	GT-1
14.05 - 14.20	WP-13	WP-16	SW-4	WP-19	GT-2
14.20 - 14.35	Question & Answer Session				

14.35 - 15.05	**Coffee Break**				
15.05 - 16.50	**Parallel Session III**				
	Room 1	**Room 2**	**Room 3**	**Room 4**	**Room 5**
15.05 - 15.20	CC-9	SW-5	SS-1	GT-3	CE-1
15.20 - 15.35	CC-10	SW-6	SS-2	GT-4	CE-2
15.35 - 15.50	CC-11	SW-7	WP-20	EE-1	CE-3
15.50 - 16.05	CC-12		WP-21	EE-2	CE-4
16.05 - 16.20				SW-8	CE-5
16.20 - 16.35				SW-9	CE-6
16.35 - 16.50				SW-10	CE-7
19.00 - 22.00	**Welcome Party (Gala Dinner)**				

Day 2, 22 November 2012					
08.00- 09.00	**Parallel Session IV**				
	Room 1	**Room 2**	**Room 3**	**Room 4**	**Room 5**
08.00 - 08.15	EE*	WP-22	WP-26	WP-30	WP-34
08.15 - 08.30	EE-3	WP-23	WP-27	WP-31	WP-35
08.30 - 08.45	EE-4	WP-24	WP-28	WP-32	WP-36
08.45 - 09.00	EE-5	WP-25	WP-29	WP-33	WP-37
09.00 – 09.30	**Coffee Break**				
09.30 - 10.30	AUN/SEED-Net update and discussion on collaborative research				
10.30 - 11.00	**Plenary Lecture 3** Prof. Yasushi Kiyoki Faculty of Environment and Information Studies, Keio University, Japan Theme: A Multimedia Data Mining System for Environmental and Cross-Cultural Computing				
11.00 - 11.30	**Plenary Lecture 4** Prof. Naoyuki Funamizu Graduate School of Engineering, Hokkaido University, Japan Theme: Sustainable Sanitation				
11.30 - 12.00	**Closing Ceremony**				
12.00 - 13.30	**Farewell Lunch**				

LIST OF PAPER

Water Pollution Control				
Code	**Writers**	**Abstract title**	**Affiliation**	**Country**
WP 1	Guanglei Qiu & Yen-Peng Ting	Osmotic Membrane Bioreactor for Municipal Wastewater Treatment: System Performance, Flux Stability and Membrane Fouling	NUS	Singapore
WP 2	Mohd Nordin Adlan, Puganeshwary Palaniandy, Hamidi Abdul Aziz, & Helen Jong Wan Ting	The Effect of Media Configurations on the Treatment of Landfill Leachate Using Horizontal Roughing Filter	USM	Malaysia
WP 3	Florencio Ballesteros Jr., Trina Listanco & Manny A.M. Taguba	Concocting local "BMP's" in Agriculture for Non Point Pollution Reduction in Laguna de Bai, Philippines	UP	Phillipines
WP 4	Junel B. Borbo, Mark Daniel G. de Luna	Adsorption studies on The Removal of Reactive Blue 19 and Reactive Yellow 145 using Putsan(tiwi) Clay	UP	Philippines
WP 5	Oeurng Chantha, Ly Sarann, Mok Sokun Vichet, Keo Soksamnang	Sediment Load Assessment in a Tropical Monsoon Catchment of Tonle Sap Lake Basin, Cambodia: Monitoring and Modelling	ITC	Cambodia
WP 6	Wawan Budianta	Soil Cadmium Remediation by Yogyakarta Natural Zeolite	UGM	Indonesia
WP 7	Ratchanan Chamnanmor, Pisut Painmanakul, Chaiyaporn	Study of In-line Coagulation and Flocculation Processes for Turbidity Removal: Experimental Approaches	CU	Thailand
WP 8	Thanakorn Ermukdakul, Benjaporn Boonchayaanant, Wiboonluk Pungrasmil & Pisut Painmanakul	Treatment of Wastewater from Aquacultural Pond by Two Step Processes (Rapid Sand and Slow Sand Filter)	CU	Thailand
WP 9	Siska Widya Dewi Kusumah & Heto Dwi Ariesyady	Identification of Microbiological Pollution Source in Upper Citarum River by Antibiotic Resistance Analysis of Escherichia coli	ITB	Indonesia
WP 10	Barti Setiani Muntalif, Indah Rahmatia S.S., Arwin, Lieza Corsita	Analysis of Phytoplankton Diversity and Water Quality in Aquatic Ecosystems of the Jatiluhur Reservoir	ITB	Indonesia

Water Pollution Control				
Code	**Writers**	**Abstract title**	**Affiliation**	**Country**
WP 11	Fadjari Lucia Nugroho, Setiati, Anni Rohaeni, Sri Wahjuni, Dwi Sobirachman, Adhita Abdillah, Siti Maryam Khoirunnisa	Removal of Colour Index Reactive Blue 5 (CIRB5) Anthraquinone Dye by Live Trichoderma asperellum TNC52 Isolated from the Soil of a Cacao Plantation in Riau	Universitas Pasundan	Indonesia
WP 12	Witawat Jangiam & Sarayut Petra	Biodegradation of Linear Alkylbenzene Sulfonate by AOS-15 Microorganism	BUU	Thailand
WP 13	Phong Nguyen Tan, Luan Mai Thanh	Study on Fish Processing Wastewater Treatment by Swim-bed and Stick-bed Processes	HCMUT	Vietnam
WP 14	Krittita Lertpocasombut & Maruay Kiewsa-ard	The Properties of the Ash if the Vetiver Grass Roots as a Filter Material	Thammasat University	Thailand
WP 15	Sri Puji Saraswati, Bambang Agus Kironoto, Suwarno Hadisusanto	Comparison of Some Water Quality Indices in Determining A River Quality Status (A Case Study of Gadjah Wong Stream)	UGM	Indonesia
WP 16	Mohd Suffian Yusoff, Ming Rui Lo, Hamidi Abdul Aziz	Semi-aerobic Landfill Leachate Treatment Using Oil Palm Trunk Waste-Derived Coagulant	USM	Malaysia
WP 17	Ahmad Shukri Yahaya, Nor Azam Ramli, Ahmad Zia Ul-Saufie, Hazrul Abdul Hamid, Fauziah Ahmad	Prediction of Daily Average PM10 Concentration 3 Days in Advance for Melaka, Malaysia	USM	Malaysia
WP 18	Bambang Hari P. and Hendriyana	Batch and Continuous Processes of Electrocoagulation on Industrial Wastewater	Universitas Jendral Ahmad Yani	Indonesia
WP 19	Doni Sugiyana, Marisa Handajani & Suprihanto Notodarmojo	Degradation of Textile Dyeing Wastewater Through Photocatalytic Treatment by Using Immobilized TiO2 Nanofibers Composite Catalyst	ITB	Indonesia
WP 20	Nguyen Duy Hung, Herman D. Mendoza, Nghiem Trung Dung	A Proposed Establishment of Lam River Basin's Water Monitoring System Using Passive Sampling Techniques	UP	Philippines
WP 21	Bui Xuan Thanh & Nguyen Phuoc Dan	Performance of Membrane Bioreactor Coupling With Ozonation at Different Recirculation Rate for Dyeing and Textile Wastewater Treatment	HCMUT	Vietnam
WP 22	Thipaporn Sirinukulwattana, Wiboonluk Pungrasmi & Chaiyaporn Puprasert	Treatment of Low Strength Wastewater by Rubber Granules Media AFB Reactors Without Internal Recirculation	CU	Thailand

Water Pollution Control				
Code	**Writers**	**Abstract title**	**Affiliation**	**Country**
WP 23	Inneke F.M. Rumengan	Quantitative Assessment of Benthic Community in Buyat Bay, North Sulawesi	Sam Ratulangi University	Indonesia
WP 24	Yonik Meilawati Yustiani	Study on BOD Decay Rate of Urban Rivers in Bandung City, Indonesia	Universitas Pasundan	Indonesia
WP 25	Misri Gozan, Fita Sefriana, Stephan Stauder, Jutta Eggers	Challenges in Treatment of Ciliwung River Waters	Universitas Indonesia	Indonesia
WP 26	Nontiya Chothong & Petchporn Chawakitchareon	Adsorption of Methylene Blue By Spent Coffee Grounds	CU	Thailand
WP 27	Narapong Hongprasith, Tawan Chareonpittaya, Daiki Fusamae, Jin Tanaka, Yuta Hikiji, Maliwan Kutako, Tsuyoshi Imai & Pisut Painmanakul	Study of Alternative Aeration System Applied in Aquaculture Ponds	CU	Thailand
WP 28	Desiana Prilia, Herto Dwi Arisyady & Katharina Oginawati	Analysis of Mercury in Water and Sediment Distribution and Its Bioaccumulation Potential in Fish in the Small Scale Gold Mining Area (Case study: Ciberang River, Lebak, Banten)	ITB	Indonesia
WP 29	Qomarudin Helmy, Syarif Hidayat, Luhur A. Devianto, Mochammad Chaerul	Municipal Landfill Leachate Treatment: Common Practices in Indonesia	ITB	Indonesia
WP 30	David Andrio, Marisa Handajani & Mindriany Syafila	The Potential of Ethanol Production from High Strength Organic Wastewater on Acidogenic Phase: A Preliminary Study	ITB	Indonesia
WP 31	Dita Amalia, Indah Rachmatiah S. Salami & Dwina Roosmini	Improving Water Quality of Rivers Receiving Landfill Waste Through Utilization of Pistia stratiotes L. Plants	ITB	Indonesia
WP 32	Rudy L. Widiyatno, Munawar Ali, Bambang Wahyudi, Qomarudin Helmy	Degradation of Textile Industry's Effluent Using Integrated Chemical-Biological Process	UPN-Veteran Surabaya	Indonesia
WP 33	Tazkiaturrizki, Prayatni Soewondo, Marisa Handajani	Removal Nitrogen and Phosphate in Effluent of Bojongsoang Wastewater Treatment Using Subsurface Horizontal Wetland with Continuous Feed	ITB	Indonesia

Water Pollution Control				
Code	**Writers**	**Abstract title**	**Affiliation**	**Country**
WP 34	Prismita Nursetyowati, Prayatni Soewondo and Marisa Handajani	Influence of the Influent Organic Loading on Organic Removal of Liquid Phase Biowaste in an Upflow Anaerobic Fixed Bed Reactor with Pumice Supporting Media	ITB	Indonesia
WP 35	Jaber M.A. Alkasseh, Mohd Nordin Adlan, Hj. Ismail Abustan, and Abu Bakar Mohamad Hanif	Minimum Night Flow Analysis to Estimate Water Loss: A Case Study in Kinta Valley, Malaysia	USM	Malaysia
WP 36	Irawan Sugoro, Dwiwahju Sasongko, D. Indriani, P. Aditiawati	Biosolubilization of Gamma Irradiation Lignite by Penicillium sp	ITB	Indonesia
WP 37	Syarif Hidayat and Edwan Kardena	Removal of Organic Compounds from Oilfield Produced Water in Batch Suspended Growth Bioreactor Using Endogenous Bacteria	ITB	Indonesia

Air Pollution Control				
Code	**Writers**	**Abstract title**	**Affiliation**	**Country**
AP*	Driejana	Science and Policy in Air Quality Management in Indonesia	ITB	Indonesia
AP 1	Tran Thi Thu Huong, Nguyen Duc Khanh, Pham Hoang Luong, Le Anh Tuan	A Computational Study of The Effects of Injection Strategies on Performance and Emissions of A Syngas/Diesel Dual-Fuel Engine	HUST	Vietnam
AP 2	Kania Mayang Lestari & Driejana	Performance of Alternate Absorbents in the Application of Ambient-NO2 Passive Tube Sampler in Indonesia	ITB	Indonesia
AP 3	Endah Saptutyningsih	Impact of Air Pollution on Property Values: A Hedonic Price Study for Daerah Istimewa Yogyakarta	Universitas Muhammadiyah Yogyakarta	Indonesia
AP 4	Vita Wonoputri, Mohammad Effendy, Yogi Wibisono Budhi, Subagjo	Abatement of Fugitive Methane Emission by Catalytic Oxidation: Study on Rate Parameter Estimation	ITB	Indonesia
AP 5	Saripah Sobah, Hary Sulistyo, Siti Syamsiah	Romoval of CO2 from Ammonia Industry through Coal Gasification as an Effort for Minimizing Global Warming	UGM	Indonesia

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AP 6	Esrom Hamonangan, Jetro Situmorang	Monitoring of Ambient Air Quality in 288 Locations of Province, City and Regency to Support National Air Quality Management Indonesia	Pusat Sarana Pengendalian Dampak Lingkungan (Pusarpedal)-Kementrian Lingkungan Hidup	Indonesia

Climate Change				
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CC 1	Udin Hasanudin, Amalia Julfi R., Rahmawati Nurmalasari, Agus Haryanto	Greenhouse Gases Emission Reduction Potential through Bioethanol Industry Wastewater Utilization	University of Lampung	Indonesia
CC 2	Deni Bram	The Paradox of National Climate Justice (Indonesia Emission Quota as Case Study)	Universitas Indonesia	Indonesia
CC 3	Watt Botkosal, Chhuon Kong, Chea Chanthou	The State of Climate Change in Cambodia	UGM	Indonesia
CC 4	FX. Hermawan Kusumartonoirst	Women Role on Adaptation to Face Water Crisis Impact of Climates Change: Study Case in Palue Island	Research and Development Center for Social, Economic, Environment, Board of Research and Development, Ministry of Public Works	Indonesia
CC 5	Inna Marlina, Puji Lestari, Juli Soemirat	The Impact of Global Warming to the Incidence of Dengue Hemorrhagic Fever (DHF) and The estimation of Its Burden of Disease Using Daly Parameter in Bandung City From 2005-2010	ITB	Indonesia
CC 6	Mohd Syarif Hidayat	The Thermal Environment of Urban Open Spaces in Jakarta	Universitas Mercu Buana	Indonesia
CC 7	Haryanto Wardoyo	Risk Versus Potency of the Natural Anaerobic Methane Emission	Papua Sagosia PT, Molindo Raya Industrial PT	Indonesia
CC 8	Jeark A. Principe, Ariel C. Blanco	Climate Change Impact Assessment on Soil Loss Rate in a Large River Basin Using SWAT Model, RS and GIS	UP	Philippines

Climate Change				
Code	**Writers**	**Abstract title**	**Affiliation**	**Country**
CC 9	Djoko Suwarno, Budi Widianarko, Ansje Lohr, Carolien Kroeze	Climate Change and Nutrient Export, A Scenario for Bengawan Solo River, Java	Soegijapranata Catholic University	Indonesia
CC 10	Ishak Tan	Forest Governance in Autonomy Era: A Study of Administration of Controlling at West Java Province, Indonesia	Bitari Institution, Cimahi	Indonesia
CC 11	Yeni Rahmawati, Sanggono Adisasmito, Tjandra Setiadi, I G Wenten	CO2 Removal Using Membrane Contactor in Transversal Modul	ITB	Indonesia
CC-12	Budi Kamulyan, Johan Syafri Mahathir Ahmad, Rachmad Jayadi	Adapting Climate Change by Using Roof Garden with Closed Cycle Water Utilization for Creating Micro Climate Improvement	UGM	Indonesia

Coastal Environments and Vulnerability				
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CE 1	Aung Kyaw	Geographical Analysis on the Vulnerability of Myanmar Coastal Area to Natural Disaster	Dagon University	Myanmar
CE 2	Irwan Gumilar, H.Z. Abidin, T.P. Sidiq, H. Andreas, R. Maiyudi, M. Gamal, Y. Fukuda	Mapping and Evaluating the Impact of Land Subsidence in Semarang (Indonesia)	ITB	Indonesia
CE 3	Bryan Clark B. Hernandez, Tolentino B. Moya, Ariel C. Blanco, Maria Antonia N. Tanchuling, Kazuo Nadaoka	Investigation of Saltwater Intrusion into the Coast of Guimaras Island, Philippines Using Geophysical and Geochemical Methods	UP	Philippines
CE 4	Arni Rahmawati Fahmi Sholihah, Achmad Sjarmidi	Environmental Analysis of Post Sand and Andesite Mining Land in Cimalaka and Paseh, Sumedang, West Java	ITB	Indonesia
CE 5	Tan Lay Hui Ivy	Understanding the Risk and Impact of Natural Disasters Along a Shipping Network	NTU	Singapore
CE 6	Achmad Sjarmidi, Anzilni Fathia Amasya, Lerry Martina, Sarah Saqina	Coral Reef Condition in Pangandaran Marine Nature Reserve and Tourism Park in Relation with Human Activities and Tsunami in 2006	ITB	Indonesia
CE 7	Eka Wardhani	Damage Analysis of Lake Bulakan Tangerang Municipal	Itenas	Indonesia

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Code	**Writers**	**Abstract title**	**Affiliation**	**Country**
EE 1	Yogi Wibisono Budhi, Hari Rionaldo, Allan Abraham B. Padama, Hideaki Kasai, Irwan Noezar	The Challenge of Process Intensification for Improved Hydrogen Production as Clean and Sustainable Energy Carrier in the Future	ITB	Indonesia
EE 2	Edi Iswanto Wiloso, Reinont Heijungs	Key Issues in Conducting Life Cycle Assessment of Bioenergy Systems	Research Center for Chemistry, Indonesian Institute of Sciences (LIPI)	Indonesia
EE 3	Conrad Allan Jay R. Pantua	Life Cycle Assessment of Fiber Reinforced Composite Materials in A Solar Powered Racing Car	DSLU	Philippines
EE 4	Jefry A. Torhis Simanjuntak, Muhammad Alfalah Fauzi	Turbine Application Analysis Based on Ocean Current Characteristics under Suramadu Bridge	ITB	Indonesia
EE 5	Erna Subroto, R. Manurung, H.J. Heeres, A.A. Broekhuis	Solvent Assisted Hydraulic Pressing of Jatropha curcas Kernel	Rijks Universiteit Groningen	The Netherlands

Green Technology				
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GT 1	Aviasti	Efforts of Industrial Estate in Indonesia to Create the Eco Industrial Park (Case Study: Industrial Zone in District of Karawang and Bekasi	Bandung Islamic University	Indonesia
GT 2	Sarah Balfas, Arief Sudradjat	Rainfall Depth Determination for Green Infrastructure Development in the Context of Water Resources Sustainability (Case Study: Cikapundung, Cisangkuy, and Ciwidey Sub Watershed)	ITB	Indonesia
GT 3	Yanita Hanastasia Sinaga, Arief Sudradjat	Initial Study on Determination of Low Impact Development Technology/Green Infrastructure for Managing Stormwater using Geographic Information System (Case Study: Upstream Citarum River Basin Non Urban)	ITB	Indonesia
GT 4	Rachman Setiawan, Adi Ekaputra, Nanang Ali Sutisna	Study on Noise Behaviour of Passenger Car Tyre for "Green Tyre" Design	ITB	Indonesia

Sustainable Consumption and Production				
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SC 1	Petchporn Chawakitchareon, Titima Wongaree	Ethanol Production from Cellulosic Materials by Simultaneous Saccharification and Fermentation	CU	Thailand
SC 2	Vilandri Astarini, Pingkan Aditiawati, Achmad Sjarmidi	Sustainable Production and Consumption Response Healthy Sugar Isomaltulose Fermented by Protaminobacter rubrum in Bandung, West Java	ITB	Indonesia
SC 3	Martha Aznury, Azis Trianto, Adi Pancoro, Tjandra Setiadi	Effect of Feeding Time of Volatile Fatty Acids from Palm Oil Mill Effluent on Production Polyhydroxyalkanoates by Ralstonia eutropha JMP 134 in Batch Fermentation	ITB	Indonesia
SC 4	Ying-Wen Chang, Ching-Hwa Lee, Ching-Hua Liao, Xiang-Ren Lin, Wan-Chi Chang, Li-Jie Yu, Shih-Zong Syu, Jain-Jhong Wong	Leaching of Scrap Silicon Wafer by Nitric Acid	Da-Yeh University	Taiwan
SC 5	Silvi Octavia, I.D.G. Arsa P., Ronny Purwadi, Tatang H. Soerawidjaja	Determining the Enzyme Accessibility of Pretreated Lignocellulosic Substrates by Simon's Stain Method Compared to Enzymatic Hydrolysis	ITB	Indonesia
SC 6	Supaknapar Rattanagumpol and Thidarat Bunsri	Development of Light Fermentative Biohydrogen Process for Treatment of Starch Wastewater	KMITL	Thailand

Sustainable Sanitation				
Code	**Writers**	**Abstract title**	**Affiliation**	**Country**
SS 1	Dwipayanti N.M.U, Suandi I.K.R, Akbar, S., Zonni, H.	The Implementation of Community Led Total Sanitation in Muntigunung, Tianyar Barat Village, Karangasem-Bali	Udayana University	Indonesia
SS 2	Adithyanti Febriana, Prayatni Soewondo, Marisa Handajani, Mayrina Firdayati	Effect of Glucose Addition on Lactofermentation Process in Faeces Treatement Based on Terra Preta Sanitation System Concept	ITB	Indonesia

Sustainable Waste Management				
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SW 1	Vu Duc Thao, Cao Xuan Mai, Vu Kiem Thuy, Ta Quang Tuyen Hung	Testing Adsorption Capacity of Rice Husk Carbon Produced by a New Method	HUST	Vietnam
SW 2	Aye Aye Thant	Analysis of Solid Waste Composition and Disposal Systems for Mandalay City, Myanmar	Mandalay Technological University	Myanmar
SW 3	Jonathan Rivera Dungca, Faustino J., Misa J. F., Napa R. D., Ramos D.J.R	Triaxial Shear Strength of Fly Ash and Bottom Ash as Structural Fill	DSLU	Philippines
SW 4	Maria Antonia Tanchuling, Augustus Resurreccion, Leah Diola, Camille Morales, Adrian Patacsil, Manuel Sy, Christine Razon, Stephanie Bundoc	Assessing the Solid Waste Management System of the University of the Philippines Diliman	UP	Philippines
SW 5	Le Van Khoa, Tran Minh Chi, Pham Minh Chi	Assessment of E-Waste Collection Model in Ho Chi Minh City	HCMUT	Vietnam
SW 6	El Khobar M. Nazech, Irma Gusniani S., Aisha Sean J.	Study on Soil-Compost Mixture to Cover Landfill	Universitas Indonesia	Indonesia
SW 7	Dissayapong Hoksuwan, Nattawin Chawaloesphonsiya, Patiparn Panyapalakul, Pisut Painmanakul	Effect of Various Operating Conditions on Preliminary Treatment of Waste Containing Aluminium Dross	CU	Philippines
SW 8	Reo Audi & Emenda Sembiring	Effect of Provision of Shopping Bag and Information on Plastic Bag Waste Reduction in Bandung City	ITB	Indonesia
SW 9	Emenda Sembiring, Listra Endenta Sitorus	The Effect of Compost Application on Soil Organic Carbon and CO2 emission	ITB	Indonesia
SW 10	Vivi Novianti, Devi N. Choesin, Didik Suprayogo, Djoko T. Iskandar, Huzen Suryawardana	Accelerating Primary Succession on Coal Mine Overburden Dumping Sites in Satui, South Kalimantan, Indonesia: Plants Species Selection and Growth Performance	ITB	Indonesia

Identification of Microbiological Pollution Source in Upper Citarum River by Antibiotic Resistance Analysis of *Escherichia coli*

Siska Widya Dewi Kusumah[1] and Herto Dwi Ariesyady[2]

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Abstract. Water quality degradation of upper Citarum River has become an important problem in Bandung, Indonesia. Sudden increase of water pollution from agriculture and domestic activities has worsened the quality of the river. Targeted efforts to prevent further pollution can only be performed if the source of the pollutants has been identified. With Microbial Source Tracking method, particular contaminants can be traced up to their source so that the management efforts can be done by the concept of point source. Antibody resistance analysis (ARA) can be used to distinguish the same bacteria from different sources by comparing their resistance to various antibiotics. This method can be used to determine whether the source of *Escherichia coli* contamination comes from humans or animals. In this research, sources of *Escherichia coli* can be divided into human, chicken, goat and cow. The Upper Citarum River is divided into nine segments based on the presence of branching rivers. *Escherichia coli* isolates taken from all segments of the river were tested against ten types of antibiotics and the resistance profiles were recorded. These profiles were compared with *Escherichia coli*'s profiles taken from actual feces of human and livestock. The result shows that *Escherichia coli* of human origin are dominant in all segments except Bojongsoang. Therefore, all these area need to develop more domestic treatment plants. *Escherichia coli* originating from chickens are dominant in Bojongsoang and Dayeuhkolot. *Escherichia coli* from goats are detected high in Katapang, Margaasih and Nanjung segment, while *Escherichia coli* from cows are dominant at Baleendah segment. Therefore, those areas need to concentrate in development of treatment plants for livestock waste. In wider aspect, the results may used by local stakeholders to adjust their priorities in pollution prevention efforts.

Keywords: *Antibiotic Resistance Analysis, Citarum, Escherichia coli.*

1 Introduction

The Upper Citarum River is the main water source for irrigation, home industry and domestic activities for peoples in West Java region. However, environmental degradation leads to extended critical land and worsened water

pollution from industrial, agricultural and domestic activities as been noted by Cita-Citarum [1]. Utilization of low quality water may increase health risks of the people. Actual efforts on Upper Citarum River restoration consist of routine water quality monitoring, industrial waste management, domestic waste management and river soil dredging. Water quality restoration is a high cost effort since seven million of population, hundreds of factories, and more than six thousand livestock are spread along the 270 Km of the river. Therefore, according to Bitton [2] effective pollution prevention programs could be done when the source of pollution had been known. The main pollution prevention effort in areas or river segments is possibly different since populations in each sub-watershed have distinct activities, such as stock farms, fisheries, industries, rural, and urban areas.

Microbial pollution originated from domestic, agricultural, livestock and fisheries activities raise the number of fecal coliform in water. Since those activities produce the same bacteria which detected by the standard method of MPN (Most Probable Number), the pollution source considered as *non-point source* and only the dispersion could be determined. *Microbial Source Tracking* is able to track down fecal coliform pollution to distinguish its source, therefore the source could be considered as *point source* as stated by Ferguson [3].

According to Ferguson [3], two main methods of MST are the conventional and modern methods. The conventional method using culture characterization and Microbial biochemical tests for identification, while the modern method using *phenotyping* dan *genotyping.* A study conducted by Bower [4] shows that genetic marker detection of *gen uidA Escherichia coli* and *Bacteroidetes* in Lake Michigan was proved succeed to identify the source of human fecal pollution and the results was compatible with standard Microbial method. *Antibody resistance analysis (ARA)* is one of *phenotyping* method which able to distinguish same bacteria which originated from different sources based on their diversities of antibiotic resistance profile. This was made possible by the difference of antibiotic consumption pattern by human and livestock. Wiggins [5] found that utilization of ARA had succeeded to identify the source of fecal pollution in Moores Creek, Virginia.

2 Methodology

This research conducted in two *Escherichia coli* isolates sampling. Isolates taken from actual fecal samples was called the library isolates and the isolates from river water samples are the tested isolates. The source of *Escherichia coli* is divided into human, cow, goat and chicken. Antibiotic resistance pattern from these groups are called the library. The library isolate is originated from fecal

matter of human, cow, goat and chicken in Upper Citarum watershed. Human fecal samples are taken from four septic tanks in Katapang, Bojongsoang, Dayeuhkolot and Margaasih Sub Districts. Cow's fecal samples are taken from slaughter house in Cibolerang and cow farm in Majalaya Sub District. Chicken fecal samples are comes from chicken farm house in Margaasih Sub District while goat fecal samples are comes from livestock in Katapang Sub District. The choices of fecal sampling location are based on the distance to Upper Citarum River, antibiotic consumption pattern and its potency of fecal runoff onto the river. Sampling was conducted in on 3rd week of October 2012 for two consecutive days.

Isolation of *Escherichia coli* is conducted through growing the bacteria from water samples on selective and differential media and selects the colonies with desirable characteristic. *Escherichia coli* will produce gas on EC broth when incubated in 44^0C and shows dark colonies with metallic sheen on Levine EMB agar. Reassuring of selected colonies is done through gram staining until a single bacterium is obtained. Five *Escherichia coli* isolates are collected from each fecal source.

The tested *Escherichia coli* isolates are obtained from river water samples. Nine sampling point are chosen along Upper Citarum River based on the appearance of branched river and its land use. Sampling location is shown on **Figure 1**. Sampling was conducted on 3rd week of October 2012 for two consecutive days. Isolation method of *Escherichia coli* from the tested water samples are the same as the library isolates. Five *Escherichia coli* isolates are collected from each sampling point.

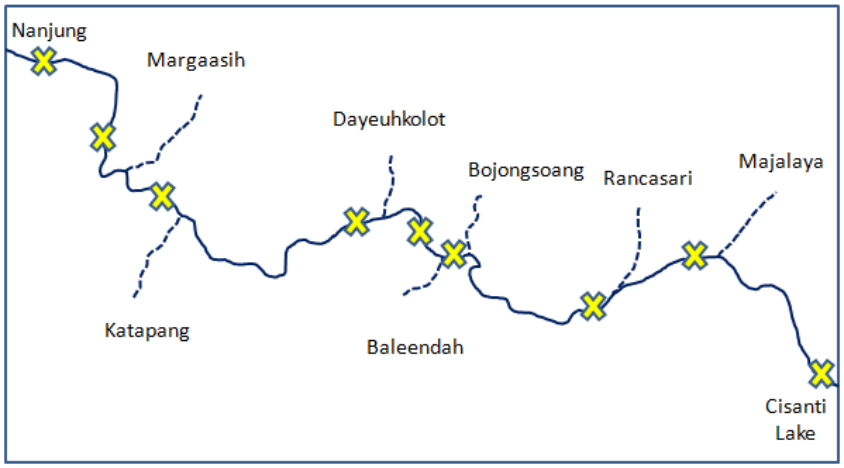


Figure 1 Cross Mark Shows Sampling Location in the Upper Citarum River

Antibiotic resistance analysis is conducted by disk diffusion method in Mueller Hinton Agar as stated in manual of antimicrobial susceptibility testing by Coyle [6]. Concentration of various antibiotics which used in this study is shown in **Table 1**. There are 10 antibiotic disks with certain concentration. The agar then incubated in 35^0C for 18-24 hours.

Table 1 Antibiotics Used in the Study

No.	Antibiotics	Concentration	Unit
1	Kanamycine	30	µg/ml
2	Tetracycline	30	µg/ml
3	Ampicillin	10	µg/ml
4	Chloramphenicol (*double dose*)	60	µg/ml
5	Cotrimoxazole (*quarter dose*)	100	µg/ml
6	Streptomycine	10	µg/ml
7	Cotrimoxazole	25	µg/ml
8	Erythromycin	15	µg/ml
9	Chloramphenicol	30	µg/ml
10	Oxytetracycline	30	µg/ml

Clear zone on Mueller Hinton Agar is measured and compared with diameter of *breakpoint* standard of NCCLS/ACLS as seen in **Table 2** to determine the antibiotic resistance characteristic.

Table 2 Diameter of Breakpoint Standard NCCLS/ACLS

Antibiotic	Concentration (µg/ml)	Sensitive	Intermediate	Resistant
Ampicillin*	10	≥ 14 mm	12-13 mm	≤11 mm
Chloramphenicol¥	30	≥18 mm	13-17 mm	≤12 mm
Kanamycin†	30	≥18 mm	16-17 mm	≤15 mm
Oxytetracycline‡	30	≥19 mm	15-18 mm	≤14 mm
Streptomycin*	10	≥15 mm	12-14 mm	≤11 mm
Tetracycline¥	30	≥19 mm	15-18 mm	≤14 mm
Erythromycin†	15	≥21 mm	19-20 mm	≤18 mm
Cotrimoxazole*	23.75/1.25	≥16 mm	11-15 mm	≤10 mm

Source: *hhmi.org [7]; †eucast.org[8]; ‡jmilabs.com & conservancy.umn.edu[9]; ¥Harley [10]

Characterization of *Escherichia coli* from library and water samples isolates are classified by logistic regression analysis. The equation results in number of probability of the fecal source of each *Escherichia coli* isolates. The universal equation is shown in **Equation [1]**:

$$\text{Log it } (p_i) = \beta_0 + \beta_1\text{Ampicillin} + \beta_2\text{Chloramphenicol} + \beta_3\text{Kanamycin} + \beta_4\text{Oxytetracyclin} + \beta_5\text{Streptomycin} + \beta_6\text{Tetracycline} + \beta_7\text{Erythromycin} + \beta_8\text{Cotrimoxazole} + \beta_9\text{Cotrimoxazole4} + \beta_{10}\text{Chloramphenicol2} \quad \textbf{(1)}$$

3 Results and Discussion

Ten isolates from each fecal source are tested against ten types of antibiotics. Numbers of resistance isolates are shown in **Figure 2**. Generally, all *Escherichia coli* are more susceptible to erythromycin, oxytetracycline, kanamycine and ampicilline. Antibiotic resistance to chloramphenicol, cotrimoxazole, streptomycine and tetracycline are more various among isolates from different feces. This is due to antibiotic consumption pattern between human and livestock. The last four antibiotics could be used as determinant antibiotic to classify the unknown isolates taken from Upper Citarum River based on their resemblance of antibiotic resistance profile.

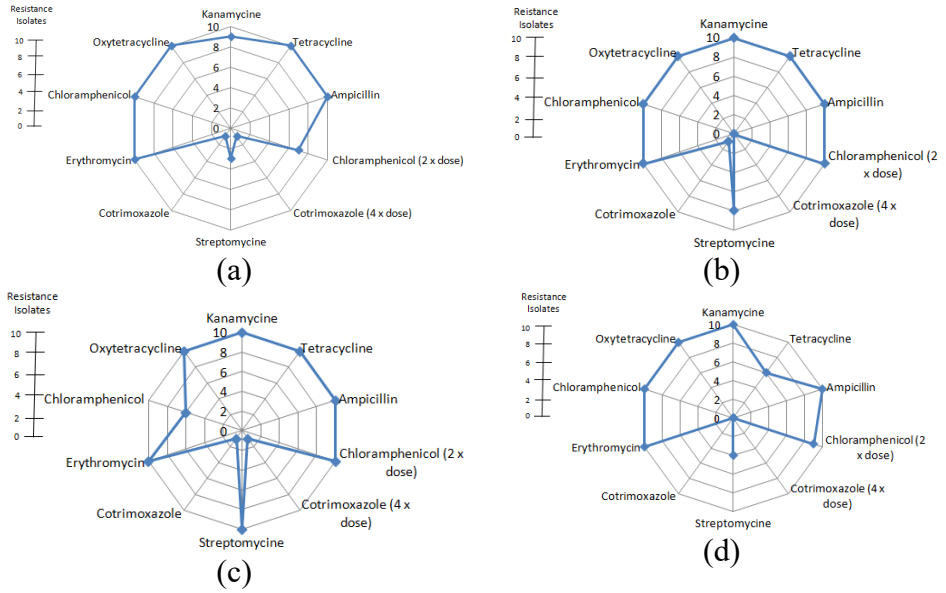


Figure 2 Number of Antibiotic Resistance-*Escherichia coli* which taken from (a) Chicken, (b) Cow, (c) Goat, and (d) Human feces.

Antibiotic resistance profile from library isolates produce constancies in regression equation as the probability of group member determination as shown in **Table 3**.

Table 3 Diameter of Breakpoint Standard NCCLS/ACLS

Constance	Source of *Escherichia coli*			
	Chicken Feces	**Goat Feces**	**Cow Feces**	**Human Feces**
β_0	-19.403	0.916	-22.589	21.203
β_1	0	0	0	0
β_2	0	-22.119	20.717	0
β_3	0	0	0	0
β_4	0	0	0	0
β_5	-1.723	20.287	1.386	0
β_6	39.64	0	0	-22.812
β_7	0	0	0	0
β_8	0	0	0	0
β_9	20.459	0	0	0
β_{10}	0	0	0	0

Implementations of those equations produce the identification of *Escherichia coli* pollution source in every segment as seen in the next figures**.**

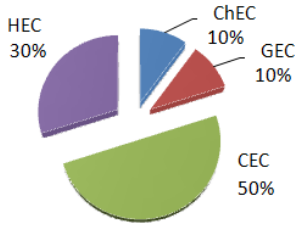


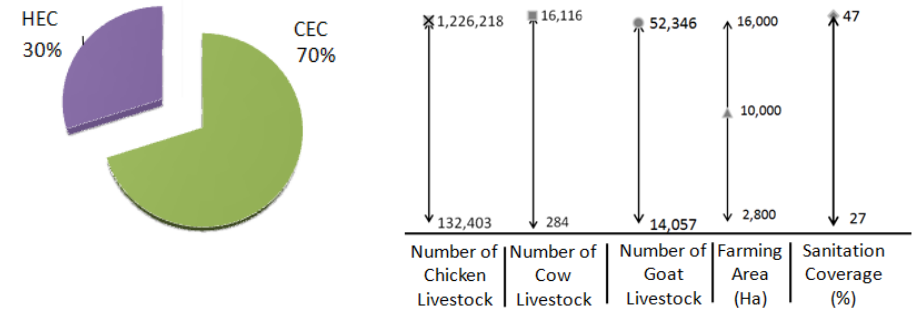
Figure 3 Composition of *Escherichia coli* Source in Cisanti Lake Outlet; HEC: Human *Escherichia coli;* ChEC: Chicken *Escherichia coli;* CEC: Cow *Escherichia coli;*GEC: Goat *Escherichia coli*

Figure 3 shows that *Escherichia coli* is also found in Cisanti Lake Outlet, although it is used as negative control. However, no significant water pollution sources are found in this area. Cisanti Lake outlet was considered as negative control. Ideally this region not contains any *Escherichia coli* from human or livestock origin. Local inhabitant has several livestock in limited number to help their activities in the rice field. Recreation activities also produce fecal

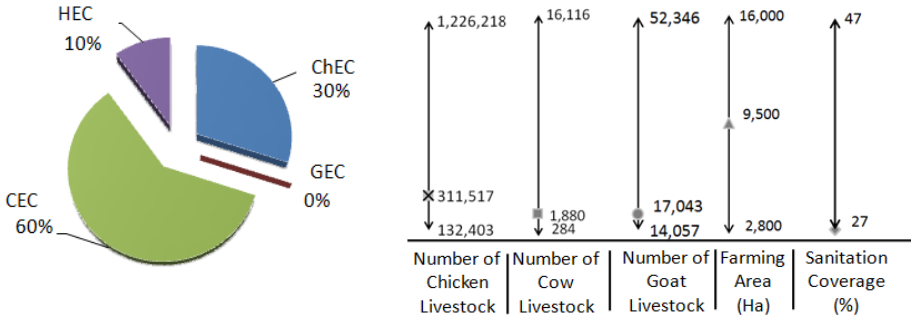
pollution in small counts. No fecal waste installations are found here, since all the farming activities are operated traditionally.

Figure 4 Compositions of *Escherichia coli* Source in: (a) Majalaya; (b) Rancasari; and (c) Bojongsoang with its Environmental Condition

Sampling location for *Escherichia coli* isolates in library group was too concentrated in the middle segments of Upper Citarum River, therefore the strenght for differentiate between fecal sources only 75% which calculated by the logistic regression.



(a)



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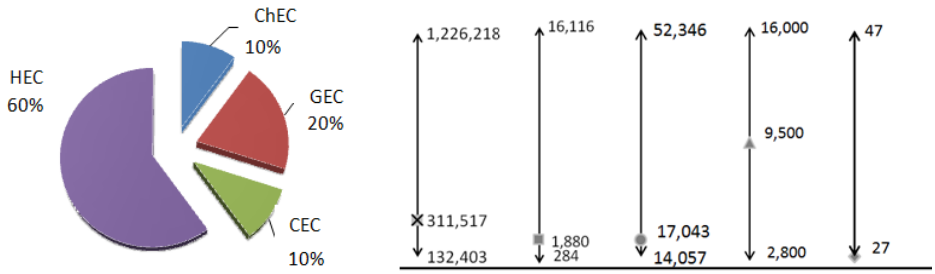

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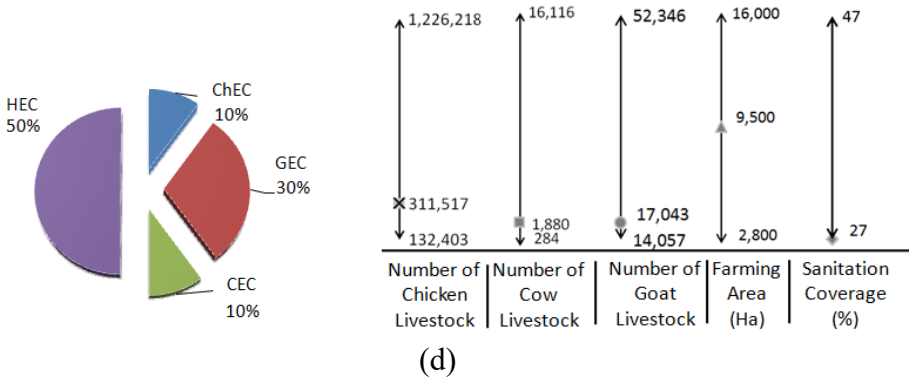

(d)

Figure 5 Compositions of *Escherichia coli* Source in: (a) Baleendah; (b) Dayeuhkolot; (c) Katapang; and (d) Margaasih with its Environmental Condition

Figure 4 and **Figure 5** shows that Human *Escherichia coli* (HEC) were dominated the Majalaya, Rancasari, Katapang and Margaasih regions. Since human fecal coli in the river could rise from fecal run off, these area need to develop more sanitation installation. Middle segments of Upper Citarum River have human fecal waste installation located in Bojongsoang. It is prominent that Human *Escherichia coli* in this area were low. Highest and lowest numbers of livestock, farming area and sanitation coverage in Upper Citarum watershed are also shown in those figures as scale bar

Chicken *Escherichia coli* (ChEC) was dominated the Bojongsoang and Dayeuhkolot regions, even though number of chicken livestock in those areas were low. Fecal coli contamination in the river are possibly comes from poor sanitation installation and high fecal run off. Therefore livestock fecal management is urgently needed. However, chicken feces are often used as natural fertilizer ingredient, therefore fertilizer from farming activities could washed out onto the river.

Cow *Escherichia coli* (CEC) was detected in the first and end segments of Upper Citarum River. Only Katapang and Margaasih show low contribution of cow fecal pollution into the river. Cow is the main livestock found in Citarum region. However, cow fecal management is not consider as adequate, since no special container for fecal waste and no specific waste installation are built in the cow farms. Slaughter house have particular waste installation, but much of fecal waste are cleaned thoroughly with water spray and washed onto the nearest river.

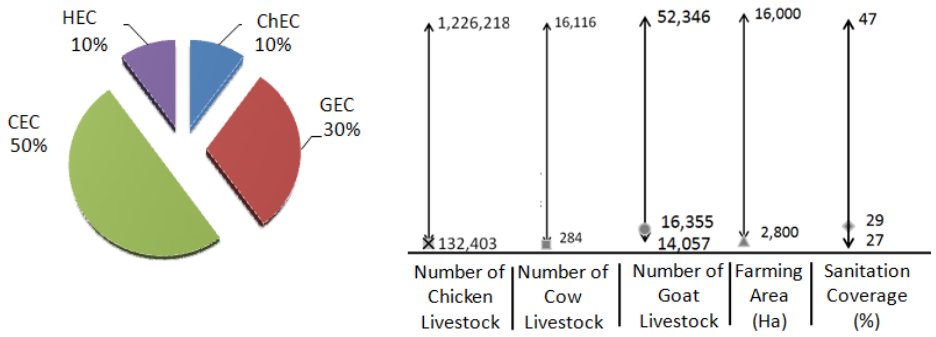

Figure 6 Compositions of *Escherichia coli* Source in Nanjung with Its Environmental Condition

Goat *Escherichia coli* (GEC) were detected in the end segments of Upper Citarum River. Katapang, Margaasih and Nanjung have low number of goat, while the segment before Katapang, which is Baleendah region, has goat livestock in great quantity. Therefore, goat fecal waste management in Baleendah consider as effective, while Katapang, Margaasih and Nanjung need to improve their livestock facilities.

Nanjung are used as positive control. This area has low number of livestock, however *Escherichia coli* from all source are detected in the river. The *Escherichia coli* derive from previous river segment carried by the river current. Thus indicated that *Escherichia coli* from all source were persistence and accumulated in the end segment of Upper Citarum River.

Tracking results shows that number of livestock doesn't directly influence the number of *Escherichia coli* in those areas. This due to the effectiveness of livestock waste treatment installation and existing condition of fecal runoff. Moreover, sanitation coverage should prevent the increment of human *Escherichia coli* in the river. The sanitation coverage in all areas of watershed is insufficient since the coverage is below 50%, even though the local government is targeting 80% for sanitation coverage.

After knowing the source of *Escherichia coli* in every segment, it is clearly obvious that each region has different pollution prevention program. Segments with high HEC (Human *Escherichia coli*) need to improve more domestic treatment plant. While segments with high CEC (Cow *Escherichia coli*), ChEC (Chicken *Escherichia coli*), GEC (Goat *Escherichia coli*) are needed to develop livestock waste treatment plant and avoid fecal wash-out into the nearest river through the sewer system.

4 Conclusions

Escherichia coli originated from human were dominant on all areas beside Bojongsoang. Therefore, those areas are needed to develop more domestic treatment plant. Human fecal waste installation in Bojongsoang are successfully proven in reduce the number Human *Escherichia coli* in Upper Citarum River. Low sanitation coverage is one causal factor of human fecal waste pollution on the river.

Chicken *Escherichia coli* was dominated the Bojongsoang and Dayeuhkolot regions. Goat *Escherichia coli* were detected in the Katapang, Margaasih and Nanjung regions. Cow *Escherichia coli* was detected in the first and end segments of Upper Citarum River.

Number of livestock doesn't influence the number of *Escherichia coli* in those areas. This condition was influenced by the effectiveness of livestock waste treatment installation and fecal runoff through stall cleaning process and fertilizer usage.

5 References

[1] Cita-Citarum (2009). *Main Report Citarum Wanadri Expedition.* Available at: www.citarum.org. (11 February 2010).

[2] Bitton G. (2005). *Microbial Indicators of Fecal Contamination: Application to Microbial Source Tracking*. Department of Environmental Engineering Sciences. University of Florida.

[3] Ferguson D. and Griffith J. (2010). *Microbial Source Tracking*. SCCWRP. California. Available at: www.waterboards.ca.gov. (08 October 2011).

[4] Bower P. A., Scopel C. O., Jensen E. T., Depas M. M., and McLellan S. L. (2005). Detection of genetic markers of fecal indicators bacteria in Lake Michigan and determination of their relationship to *Escherichia coli* densities using standard microbiological methods. *Applied and Environmental Microbiology*, **71** (12), 8305-8313.

[5] Wiggins B. A. (2001). *Use of Antibiotic Resistance Analysis (ARA) to Identify Nonpoint Sources of Fecal Contamination in the Moores Creek Watershed*. Department of Biology, James Madison University, Harrisonburg, Virginia.

[6] Coyle B. M. (2005). *Manual of Antimicrobial Susceptibility Testing*. American Society for Microbiology.

[7] HHMI, *Measuring Antibiotic Resistance*, University of Colorado, http://www.hhmi.org, (3 November 2011).

[8] European Committee on Antimicrobial Susceptibility Testing, *Breakpoint tables for interpretation of MICs and zone diameters version 10 December 2009,* http://www.eucast.org, (10 March 2012).

[9] Apley, Mike, *Clinical Pharmacology-Reasonable and Not-So-Reasonable Application in Dairy Cattle,* Department of Clinical Science, Kansas State University, http://conservancy.umn.edu, (5 November 2011).

[10] Harley J. P. and Prescott L. M. (2002). *Laboratory Exercises in Microbiology*. The McGraw-Hill Companies.