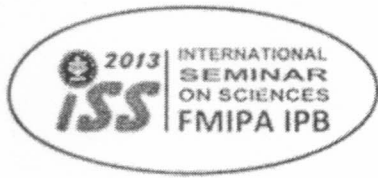


ISBN 978-979-95093-9-0



PROCEEDINGS

INTERNATIONAL SEMINAR ON SCIENCES 2013

"Perspectives on Innovative Sciences"

FACULTY OF MATHEMATICS AND NATURAL SCIENCES,
BOGOR AGRICULTURAL UNIVERSITY
IPB International Convention Center
15 - 17th November 2013

Published By



Bogor Agricultural
University



Faculty of Mathematics and
Natural Sciences



ISBN : 978-979-95093-9-0

PROCEEDINGS

ISS 2013

International Seminar on Sciences 2013 "Perspectives on Innovative Sciences"

Bogor 15-17 November 2013

IPB International Convention Center

Published by



Faculty of Mathematics and Natural Sciences
Bogor Agricultural University

Copyright© 2014

Faculty of Mathematics and Natural Sciences, Bogor Agricultural University

Proceedings of International Seminar on Sciences 2013 "Perspectives on Innovative S
Bogor 15-17 November 2013.

Published by: FMIPA-IPB, Jalan Meranti Kampus IPB Dramaga, Bogor 16680

Telp/Fax: 0251-8625481/8625708

<http://fmipa.ipb.ac.id>

ix + 395 pages

ISBN: 978-979-95093-9-0

FOREWORD

The International Seminar on Sciences 2013, which had the main theme "Perspectives on Innovative Sciences", was organized on November 15th -17th, 2013 by the Faculty of Mathematics and Natural Sciences, Bogor Agricultural University. This event aimed at sharing knowledge and expertise, as well as building network and collaborations among scientists from various institutions at national and international level.

Scientific presentations in this seminar consisted of a keynote speech, some invited speeches, and about 120 contributions of oral and poster presentations. Among the contributions, 66 full papers have been submitted and reviewed to be published in this proceeding. These papers were clustered in four groups according to our themes:

- A. Sustainability and Science Based Agriculture
- B. Science of Complexity
- C. Mathematics, Statistics and Computer Science
- D. Biosciences and Bioresources

On this occasion, we would like to express our thanks and gratitude to our distinguished keynote and invited speakers: Minister of Science and Technology, Prof. Manabu D. Yamanaka (Kobe University, Japan), Prof. Kanaya (Nara Institute of Science and Technology, NAIST, Japan), Prof. Ken Tanaka (Kyushu University, Japan), Emmanuel Paradis, PhD. (Institut de Recherche pour le Développement, France), Prof. Dr. Ir. Rizaldi Boer, MS (Bogor Agricultural University), and Prof. Dr. Ir. Antonius Wanto, M.Sc. (Bogor Agricultural University).

We would like also to extend our thanks and appreciation to all participants and referees for their wonderful cooperation, the great coordination, and the fascinating efforts. Appreciation and special thanks are addressed to our colleagues and staffs who help in editing process. Finally, we acknowledge and express our thanks to all friends, colleagues, and staffs of the Faculty of Mathematics and Natural Sciences IPB for their help and support.

Bogor, March 2014

Organizing Committee

International Seminar on Sciences 2013

Table of Content

	Page
Board of Editors	iii
Foreword	iv
Table of Content	v
A. Sustainability and Science Based Agriculture	1
Development of a natural rubber dryer Based on multi energy resources (biomass, solar and wind)	3 Didin Suwardin, Afrizal Vachlepi, Mili Pubaya, Sherly Hanifarianty
Characterization of HDTMABr-modified Natural Zeolite and its Application in Cr(VI) Adsorption	7 Budi Riza Putra, Latifah K Darusman, Eti Rohaeti
Potency of <i>Andrographis paniculata</i> , <i>Tinospora crispa</i> , and Combination Extract as α -Glucosidase Inhibitor and Chromatographic Fingerprint Profile of the Extracts	17 Wulan Tri Wahyuni, Latifah K Darusman, Rona Utama
Utilization of Frond Palm Oil as Second Generation Bioethanol Production using Alkaline Pretreatment and Separated Hydrolysis and Fermentation Method	21 Deliana Dahnum, Dyah Styarini, Sudiarmanto, Muryanto, Haznan Abimanyu
Pretreatment of Grass Biomass with Biological Process for Efficient Hydrolysis	27 Desy Kurniawati, Muhamad Natsir, Rahmi Febrialis and Prima Endang Susilowati
Alkaloid Compounds from Oil-Free Mahogany Seed (<i>Swietenia macrophylla</i> , King) and Hypoglycemia Effect of Mahogany Seed on The Rat (<i>Rattus novergicus</i>)	31 Sri Mursiti, Sabirin Matsjeh, Jumina, and Mustofa
Utilization Of Vetiver Roots Waste Product as Strong, Low Density, and Eco Friendly Material Pot	43 Galuh Suprobo, Tatang Gunawan, Cynthia Andriani, Rio Candra Islami
Green Products from Wastewater of Tempe Industry	47 Susanti Pudji Hastuti, Yofi Bramantya Adi, Bary Fratama, Samuel Arunglabi, Dewi KAK Hastuti, and Santoso Sastrodiharjo
Saccharification of Oil Palm Empty Fruit Bunch After Alkaline Pretreatment Followed by Electron Beam Irradiation for Ethanol Production	55 Muryanto, Eka Triwahyuni, Yanni Sudiyani
Isolation and Screening of Endophytic Bacteria from Bark of Raru Plant (<i>Tarrietia ribiginosa</i>) and Their Potential for Bioetahnol Production	61 Wasinton Simanjuntak, Heri Satria, and Nurul Utami

The Effect of Hypertension Herbs Formula to The Kidney Functions	Agus Triyono, Saryanto	67
The Use of Activated Carbon from Bintaro Fruit-Shell (<i>Cerbera manghas</i>) as an Adsorbent to Increase Water Quality	Armi Wulanawati, Kamella Gustina and Djeni Hendra	71
Analysis of Active Compounds from Mangosteen Rind (<i>Garcinia mangostana</i> L.) by Binding Affinity to The Androgen Receptor as Anti-Prostate Cancer Drug Candidates	Fachrurrazie, Harry Noviardi	77
Antioxidant Activity from Formula of Jati Belanda (<i>Guazuma ulmifolia</i> Lamk.), Jambu Biji (<i>Psidium guajava</i> Linn.), and Salam (<i>Eugenia polyantha</i> Wight.) Leaves Extract	Syaefudin, Sulistiyani, Edy Djauhari Purwakusumah	81
Diversity of Bacterial Mercury Reductase Resistance (<i>merA</i>) from Bombana Gold Mine	Prima Endang Susilowati, Supto Raharjo, Rachmawati Rusdin, Muzuni	87
Brake Fern (<i>Pteris vittata</i>) as a Prospective Heavy Metal Accumulator: Utilization Potentials of Harvested Biomass and Heavy Metal	Mochamad Taufiq Ridwan, Rike Tri Kumala Dewi and Agung Hasan Lukman	91
Protein Content Enhancement of <i>Spirulina platensis</i> by Phosphorus Limitation and Nitrogen Addition in Beef Cattle Wastewater Medium	Irving Noor Arifin, Iin Supartinah Noer and Asri Peni Wulandari	99
Development immobilized enzyme of white-rot fungus for decolorization of RBBR	Ajeng Arum Sari and Sanro Tachibana	103
Simple and Rapid Screening Method for Early Identification of Salt Tolerant Foxtail Millet (<i>Setaria italica</i> L. Beauv)	Sintho Wahyuning Ardie, Nurul Khumaida, and Amin Nur	109
Synthesis of Silver Nanoparticles by Using Extracellular Metabolites of <i>Lactobacillus delbrueckii</i> subsp. <i>bulgaricus</i>	Suryani, Ridho Pratama, Dimas Andrianto	113
B. Science of Complexity		119
Regional Heat Capacity Changes due to Changes of Land Cover Composition Using Landsat-5 TM Data	Winda Aryani, Idung Risdiyanto	121
Microbial Cellulolytic Isolation and Identification from Durian Leather Waste	Hapsoh, Gusmawartati dan Ujang Al Husnah	129
Predicting Water Surplus and Water Deficit in the Paddy Rice Production Center in North Sulawesi Using the Water Balance Model	Johanis H. Panelewen, Johannes E. X. Rogi and Wiske Rotinsulu3	135
Prediction of Dustfall Generation in Ambient Air over an Inceptisol Soil Area	Arief Sabdo Yuwono, Lia Amaliah	143

Carboxymethylation of Microfibrillated Cellulose to Improve Thermal and Mechanical Properties of Polylactic Acid Composites	Fitri Adilla, Lisman Suryanegara, Suminar S. Achmadi	149
Esterification of Microfibrillated Cellulose with Various Anhydrides to Improve Thermal and Mechanical Properties of Polylactic Acid Composite	Ajeng Mawangi, Lisman Suryanegara, Suminar S. Achmadi	155
Thermal and Mechanical Properties Improvement of Polylactic Acid-Nanocellulose Composites by Acetylation	Resty Dwi Andinie, Lisman Suryanegara, Suminar S. Achmadi	161
C. Mathematics, Statistics and Computer Science		167
The comparison spatial distribution observed, estimated using Neyman-Scott Rectangular Pulse Method (NSRP), and simulation for mean of one-hour rain and probability of 24-hour rain	Rado Yendra, Ari Pani Desvina, Abdul Aziz Jemain	169
Optimal VAR Injection Based on Neural Network Current State Estimator for 20kV Surabaya Electrical Distribution System	Dimas Fajar Uman P, Ontoseno Penangsang, Adi Soeprijanto	175
Fire-Fighting Robot Navigation System Using Wall Following Algorithm and Fuzzy Logic	Karlisa Priandana, Erwin M Y Chriswantoro, Mushthofa	181
Analysis and Solving of Outliers in Longitudinal Data	Viarti Eminita, Indahwati, Anang Kurnia	187
Implementation of Flowers and Ornamental Plants Landscape Information System using Cloud Computing Technology	Meuthia Rachmaniah and Iswarawati	193
Cluster Information of Non-sampled Area in Small Area Estimation with Non-normally Distributed Area Random Effects and Auxiliary Variables	Rahma Anisa, Anang Kurnia, Indahwati	199
Study of Overdispersion for Poisson and Zero-Inflated Poisson Regression on Some Characteristics of the Data	Lili Puspita Rahayu, Kusman Sadik, Indahwati	203
The Effect of Two-Way and Three-Way Interaction of Perceived Rewards on the Relationship Quality	Enny Kristiani, Ujang Sumarwan, Lilik Noor Yulianti & Asep Saefuddin	209
Implementation of Inverse Kinematics for the Coordination Control of Six Legged Robot	Wulandari, Karlisa Priandana, Agus Buono	213
Detection of C Code Plagiarism by Using K-Means	Ahmad Ridha, Abi Panca Gumilang	219
Temporal Entity Tagging for Indonesian Documents	Ahmad Ridha, Agus Simamora	223
Multidimensional Poverty Measurement Using Counting Approach and Dual Cutoff Method in District of Banyumas	Indah Soraya, Irwan Susanto, Mania Roswitha	229

Minimizing Linear Optimization Model of Basic Reproduction Number in a Fixed Number of Vaccination Coverage using Interior Point Method Approach	D. Chaerani, A. Anisah, N. Anggriani, Firdaniza	235
Expert System for Plant Growth using Hormones and Exogenous Factors based on Fuzzy Approach	Yaasiinta Cariens, Karlina Nisa	241
The Effect of Divergent Branches on GPU-Based Parallel Program Performance	Hendra Rahmawan, Yudi Satria Gondokaryono	247
Ensemble of Extreme Estimates Based on Modified Champernowne and Generalized Pareto Distributions	Aji Hamim Wigena, Anik Djuraidah, Muhammad Hafid	253
Genetic Algorithms Application for Case Study of Multi-Criteria Decision Analysis (MCDA) on the Data Contained Missing Value	Septian Rahardiantoro, Bagus Sartono, Totong Martono	259
An Implementation of Parallel AES Algorithm for Data Encryption with GPU	Aditya Erlangga, Endang Purnama Giri, Karlisa Priandana	265
Constructing Orthogonal Fractional Factorial Split-Plot Designs by Selecting a Subdesign Dependently to Another Subdesign	Bagus Sartono, Yenni Angraini, Indahwati	269
Spatial Clustering of Hotspots using DBSCAN and ST-DBSCAN	Utsri Yustina Purwanto, Baba Barus, and Hari Agung Adrianto	275
Gap between the Lower and Upper Bounds for the Iteration Complexity of Interior-Point Methods	Bib Paruhum Silalahi	281
Black Approximation To Determine Value Of Call Option On Stock In Indonesian Stock Exchange	Jacob Stevy Seleky, Endar H. Nugrahani, I Gusti Putu Purnaba	287
Analysis of Portfolio Optimization With and Without Shortselling Basd on Diagonal Model: Evidence from Indonesian Stock Market	Kaleem Saleem, Abdul Kohar Irwanto, Endar Hasafah Nugrahani	291
Community Network Framework as a Support of Successful Agricultural Community	Rina Trisminingsih, Christine Suryadi, Husni S. Sastramihardja	299
THE TRANSMISSION MODEL OF DENGUE FEVER DISEASE: A COMPUTER SIMULATION MODEL	Paian Sianturi, Ali Kusnanto, Fahren Bukhari	305
Improving the Independence of the Components of a Decomposition in Time Series Data	Hari Wijayanto, Bagus Sartono, Casia Nursyifa	311
Modeling and Empirical Mapping of Vehicular Traffic System: Case Study of Jabodetabek Region	Endar H. Nugrahani, Hadi Sumarno, Ali Kusnanto	322

D. Biosciences and Bioresources

			323
55	A QuEChERS Based Method for The Determination of Pesticide Residues in Indonesian Green Coffee Beans Using Liquid Chromatography Tandem Mass Spectrometry	Harmoko, Rahmana Emran Kartasmita, and Astika Tresnawati	325
56	Design and Implementation of Roaster Control System Using Image Processing	Mohamad Agung Prawira Negara, Satryo Budi Utomo, Sumardi	333
57	Genetic Variation of DGAT1 EaeI Gene of Holstein Friesian in National Dairy Cattle Stations	Santiananda A. Asmarasari	339
58	The Potency of Dahlia Tubers as Prebiotic for Functional Food	Ainia Herminiati, Sri Pudjiraharti, Budi Setiawan	349
59	DNA identification using Markov Chain as feature extraction and Probabilistic Neural Network as classifier	Toto Haryanto, Habib Rijzaani, Muhammad Luthfi Fajar	351
60	Multiple Sequence Alignment with Star Method in Graphical Processing Unit using CUDA	Muhammad Adi Puspo Sujiwo, Wisnu Ananta Kusuma	359
61	Abalone (<i>Haliotis asinina</i>) Wound Detection System Using Histogram and Morphology	Noer Fitria Putra Setyono, Aziz Kustiyo, Dwi Eny Djoko Setyono	361
62	Local Alignment of DNA Sequence Using Smith-Waterman Algorithm	Fariz Ashar Himawan, Wisnu Ananta Kusuma	37
63	Agronomic performance and yield potential of 18 corn varieties in Indonesia	Anggi Nindita, Willy Bayuardi Suwarno, Surjono Hadi Sutjahjo, Perdnan	37
64	Characteristic and Phisyochemical Properties of Sweet Potatoes (<i>Ipomoea batatas</i> L)	Aji Mahmudatussa'adah	38
65	Determination of Harvesting Time of Three Peanut Varieties Based on Heat Unit Accumulation	Heni Purnamawati, Yoga Setiawan Santoso, Yudiwanti Wahyu	38
66	Respon of Celery (<i>Apium graveolens</i>) Leaves Yield to Plant Population and Seed Number Per Planting Hole	Karo, B, Marpaung, A. E., Tarigan, R., Barus, S. and Khaririyatun, N.	39

Prediction of Dustfall Generation in Ambient Air over an Inceptisol Soil Area

Arief Sabdo Yuwono ¹⁾, Lia Amaliah ²⁾

¹⁾ Department of Civil and Environmental Engineering, Faculty of Agricultural Engineering and Technology, Bogor Agricultural University (IPB), Bogor, Indonesia (email: arief_sabdo_yuwono@yahoo.co.id)

²⁾ Department of Civil and Environmental Engineering, Faculty of Agricultural Engineering and Technology, Bogor Agricultural University (IPB), Bogor, Indonesia (email: lia_amaliah92@ymail.com)

Abstract

Air quality deterioration due to bare land mishandling tends to increase according to the human activity acceleration. The environmental impact thereof is an increase of dustfall and particulate matter concentration in ambient air, increase of human respiratory diseases as well as visibility reduction. The objective of the research is firstly to measure dustfall concentration in ambient air over an area of which the land consisted of mainly Inceptisol soil. The second objective is to measure dustfall concentration in a laboratory scale ambient air. The third objective is to develop a mathematical model to predict dustfall concentration in ambient air as influenced by soil water content and wind speed. The field experiment was conducted in an open area in Bogor Municipality where the land consisted mainly of Inceptisol soil. The laboratory experiment was conducted in a tunnel model where the land surface was covered by Inceptisol soil layer of 3 cm depth. The development of mathematical model was based on those field and laboratory experiments. The materials and instruments used during the field and laboratory experiments were a set of dustfall canister [AS-2011-1], blower [Hercules; Ø 60 cm; 220 V; 170 W], digital anemometer [Lutron AM-4201], digital moisture tester [OGA TA-5], tunnel [7.6 m length; 0.76 m width; 2.4 m height], analytical balance [OHAUS Aventura Pro], Petri dish [Ø=80 mm], filter paper 10µ [Whatmann #41], universal oven [UNB 400] and timer. The result of the experiments showed the average dustfall concentration in ambient air was 8.6 and 11.1 [ton/km².month] for field and laboratory scale experiment, respectively. The fittest mathematical model to predict dustfall generation [Y] over an area of Inceptisol soil as influenced by wind speed was $Y=8.87x^2-2.34x+5.198$ where "x" denoted the wind speed over the land. The prediction model as influenced by moisture content was $Y=259.1-11.7x$ where "x" represents the soil moisture content. The result of the experiment indicated that dustfall concentration in ambient air was strongly influenced by soil moisture content.

Keywords: ambient air, dustfall, generation, inceptisol, soil moisture content.

I. INTRODUCTION

Naturally dustfall can be generated from dry soil carried out by the wind. Certain wind speed can lead to the lifting of the fines fractions of the soil surface resulting in dustfall [4, 20]. Based on the study [6], concentration of dustfall increases with increasing soil erosion due to wind. Judging from the pattern of movement by the wind, dustfall can impact both locally and globally on the ecosystem [7]. Factors affecting soil erosion are [3, 5, 8, 11, 13, 18, 19]: (1) Energy (erosivity), including the potential ability of rain and surface runoff/wind, (2) Sensitivity of land (erodibility), depending on the physical, mechanical and chemical factors, and (3) protection, dealing with land cover.

Levels of air pollution including dustfall on certain areas correlated with a combination of local

The materials and instruments used during the field and laboratory experiments were a set of dustfall canister [AS-2011-1],

meteorological factors [2]. On this basis, the objective of the research were to measure dustfall concentration in ambient air over an area of Inceptisol soil which is one of the major soil types in Java [15], to measure dustfall concentration in laboratory scale ambient air, and to develop mathematical model to predict dustfall concentration in ambient air as influenced by soil water content and wind speed.

II. RESEARCH METHODS

This study was carried out in February to March 2013. Measurements were carried out over an open area of Inceptisol soil in the Bogor Municipality and laboratory of Environmental Engineering of the Department of Civil and Environmental Engineering.

blower [Hercules; Ø 60 cm; 220 V; 170 W], digital anemometer [Lutron AM-4201], digital moisture tester [OGA TA-5], tunnel [7.6 m

length; 0.76 m width; 2.4 m height], analytical balance [OHAUS Aventura Pro], Petri dish [Ø=80 mm], filter paper 10µ [Whatmann #41], universal oven [UNB 400] and timer.

A. Measurement of Dustfall Generation in the Field and Laboratory

The placement of Dustfall Canister during direct measurements in the field was done according with national reference [14]. Measurements of soil moisture content and wind speed were conducted three times per day. The steps of dustfall

concentration measurement in the field are presented in Fig. 1.

The laboratory experiment was conducted in a tunnel where the land surface was covered by Inceptisol soil layer of 3 cm depth (Fig. 2). Wind with 1.2 m/s speed was mechanically generated by a blower 1.5 m above soil surface in the tunnel, thus forming a dustfall generation in the ambient air and hence the soil water content decreases. Generation of the dustfall was measured based on the method as shown in Fig. 1.

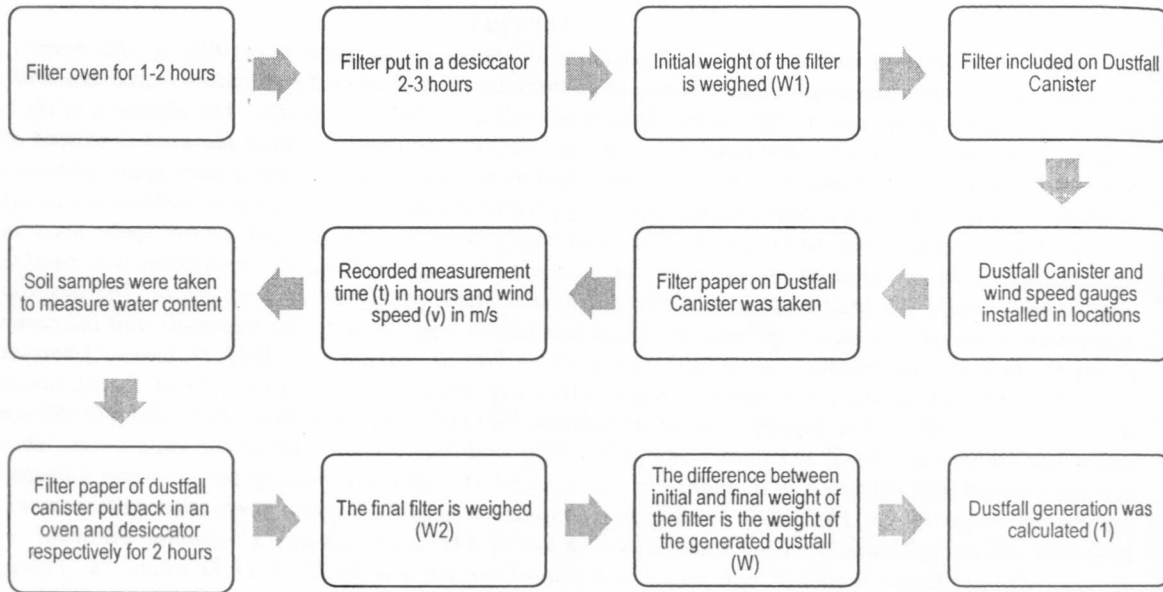


Fig. 1. Method of measuring the concentration of dustfall

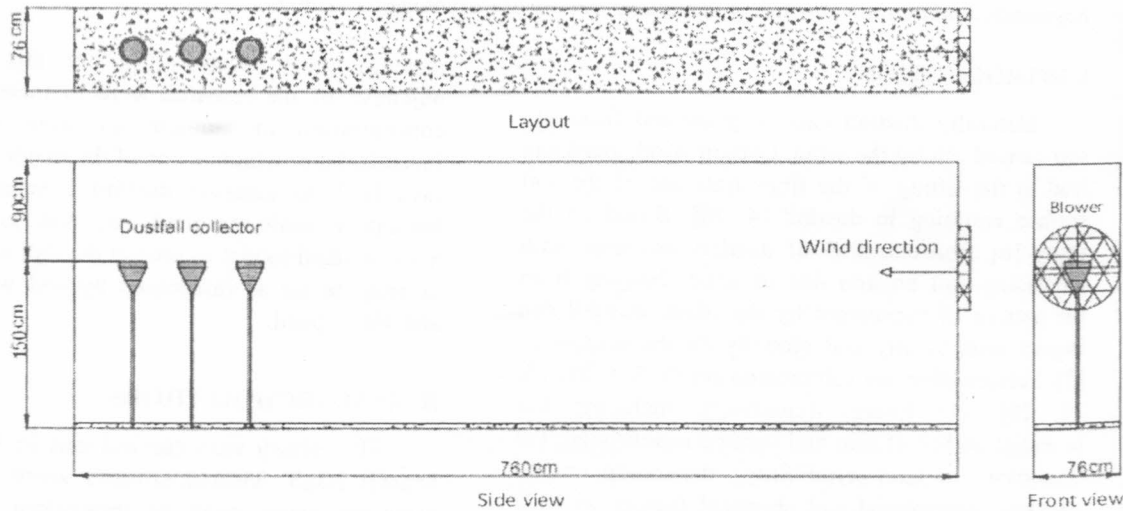


Fig. 2. Tunnel for the measurement of dustfall

$$C = \frac{w}{A \times T} \quad (1)$$

Remarks:
W = dustfall weight (tons)

A = surface area of canister (km²)
C = dustfall generation (ton/km².month)
T = measurement time (months)

B. Data Analysis Procedures

Referring to the book [16], the data analysis techniques used in this study is Pearson Correlation Technique. Data analysis was performed with the aid of a personal computer using data processing program Minitab. The development of mathematical model was based on those field and laboratory experiments.

III. RESULTS AND DISCUSSION

A. Measurement of Dustfall Generation in the Field

Generally, dustfall generation in the field was under the governmental standard according to the PP. 41 of 1999 pertaining on Air Pollution Control

except on the land clearing location of the Forester Housing (Fig. 3). Dustfall generation on land clearing location of Forester Housing has a high value due to land at the site includes the land disturbed by human activities, so that the dustfall generation tends to be larger, while the dustfall generation in open fields (Gymnasium IPB) and in Carangpulang Village were relatively low due to the presence of trees and less human activities around the measurement point. Measurement of dustfall generation in the field is influenced by local conditions such as buildings and trees, topography (valley and mountain) and local weather or meteorological factors.

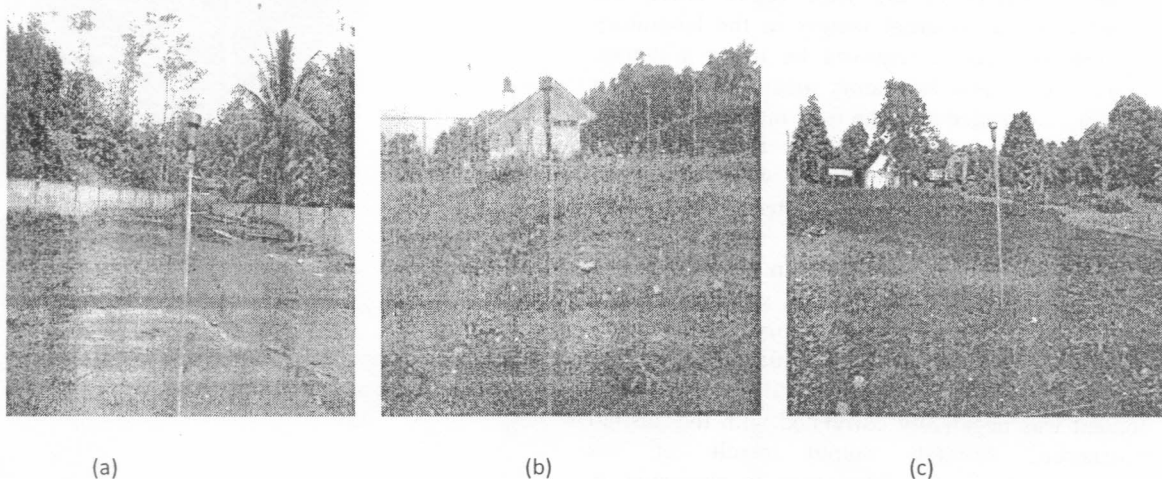


Fig. 3. Measurement of dustfall generation in Carangpulang Village (a); Gymnasium IPB (b); land clearing location of Forester Housing (c)

Based on the results of the correlation analysis with Pearson Correlation Technique, P-value generated in field measurements is less than the value of α (0.05). Thus, it indicated that there is a real relation between the dustfall generation, wind speed and soil water content on Inceptisol soil. The resulting Pearson correlation coefficient showed a negative correlation between the dustfall generation and the soil moisture content and a positive correlation between the dustfall generation and the

wind speed. This means that the higher soil moisture content, the lower dustfall generation is formed. However, with higher wind speed, the dustfall generation formed will too high. This is consistent with research [3] where the increase in soil moisture content will increase the cohesive forces between soil particles, so it requires a higher wind speed to lift the fine fractions of the soil surface in wet conditions. Minitab Output on the measurement results directly in the field is given in Table 1. Measurement result of dustfall generation in the field is presented in Table 2.

Table 1. Minitab Output of correlation measurements in the field

Parameters		Magnitude
Pearson coefficient of dustfall and soil moisture content		-0.511
P-Value		0.011
R-Sq (%)	linear relationship	26.1
	quadratic relationship	27.4
Pearson coefficient of dustfall and wind speed		0.434
P-value		0.034
R-Sq (%)	linear relationship	18.8
	quadratic relationship	19.2

Table 2. Measurement results of dustfall generation in the field

Location	Dustfall Generation (ton/km ² .month)	Wind speed (m/s)	Soil moisture content (%)
Carangpulang Village	0.8-8.6	0.1-1.5	26.2-35
Gymnasium IPB	0.4-16.7	0.1-1.0	18.0-29.2
Land clearing of Forester Housing	8.4-16.8	0.1-2.0	17.8-32.0

B. Measurement of Dustfall Generation in the Laboratory

Laboratory measurement of dustfall generation is carried out in a tunnel with 7.6 m long, 0.76 m wide and 2.4 m high. Measurement of dustfall generation on soil samples in the tunnel is presented in Fig. 4. In contrast to direct measurements in the field (open area), the influence of external factors in the laboratory measurements is removed by using a tunnel. This is because laboratory measurement can be more controlled than the field measurement one. Dustfall generation from the laboratory measurements under 1.2 m/s wind speed and 20.6-21.6% soil moisture content was 2.9-19.2 ton/km².month.

Correlation is also indicated in the relationship between the dustfall generation, wind speed and soil water content in the laboratory measurements with the P-value less than α (0.05). The resulted Pearson coefficient showed that the soil moisture content was negatively correlated with the dustfall generation. Minitab output result of the measurements in the laboratory is presented in Table 3.

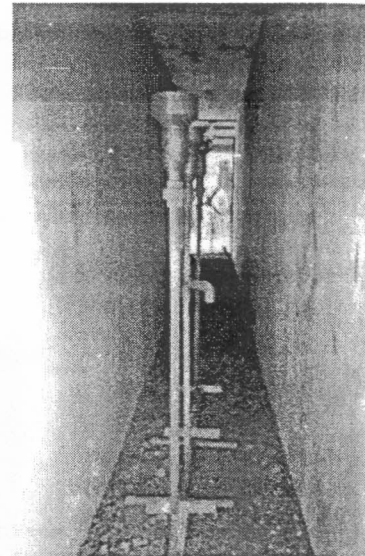


Fig. 4. Tunnel for measurement of dustfall generation on the soil samples

Table 3. Output Minitab correlation measurements in the laboratory

Parameters		Magnitude
Pearson coefficient of dustfall and soil moisture content		-0.852
P-Value		0.004
R-Sq (%)	linear relationship	72.6
	quadratic relationship	83.9

C. Correlation between Dustfall Generation, Wind Speed and Soil Moisture Content

Correlation between dustfall generation and wind speed on Inceptisol soil is quadratic with R-Sq 19.6% for wind speed 0.1-1.0 m/s (Fig. 5). It showed that dustfall generation on Inceptisol soil was influenced by local wind speed of 19.6%.

The relationship between dustfall generation and soil moisture content in the field is a quadratic one whereas such relationship in the laboratory scale is linear (Fig. 6). This quadratic relationship indicates that soil moisture content to a certain extent will not significantly influence the reduction of dustfall generation. Soil moisture content affects 27.4% (R-Sq=27.4%) of the dustfall generation in the field measurements with soil water content 17.8-35%, while for measurements in the laboratory on soil water content 20.6-21.6% obtained R-Sq 72.6%.

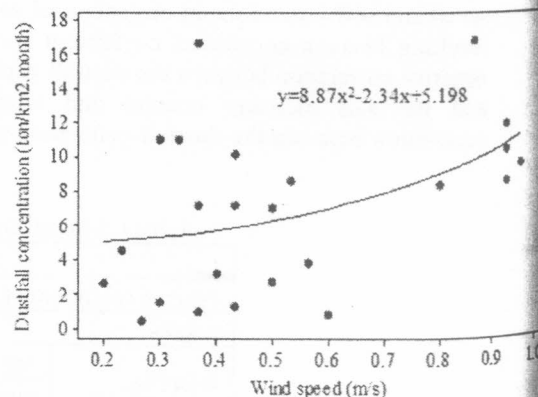
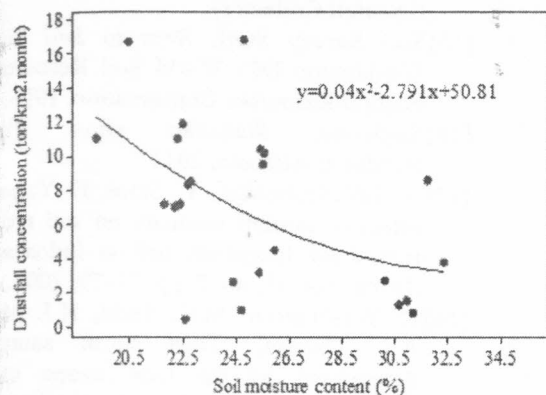


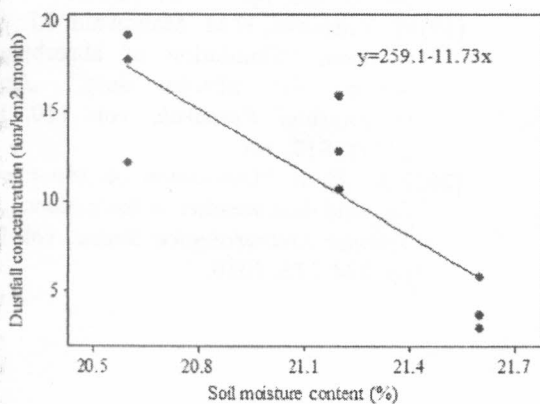
Fig. 5. Correlation between dustfall and wind speed on Inceptisol soil

The minor influence of the soil moisture content on the dustfall generation in the field measurements could be due to other factors that were not taken into account in this research.

Besides the wind speed, meteorological factors that could influence the measurement of dustfall directly in the field are temperature, relative humidity, and atmospheric pressure [2]. Based on the research [9], direct influence of relative humidity on dustfall generation formed in the field was as much as 58.1%, whereas influences of wind speed and soil moisture content were 66.9% and 52.8%, respectively.



(a)



(b)

Fig. 6. Correlation between dustfall and soil moisture content in the field (a) and in the laboratory (b)

Soil texture is also suspected to affect the correlation between dustfall generation, wind speed and soil moisture content. Soil texture is an important factor in soil erodibility for determining soil texture consistency, cohesion and soil mobility [10]. Based on the research result [17], Inceptisol soil has 70.71% clay content, 23.74% loam and 5.55% sand. High clay content in the Inceptisol soil has led to a texture which tends to be sticky when it is wet and cohesive forces between grains of soil is high. As a result, generation of dustfall would be low.

Besides soil texture, wind speed and soil moisture content, the dustfall generation in the field was influenced by the C-organic content as well. C-organic content of the soil affects the physical properties of the soil as it serves an adhesive force

between the soil particles. C-organic content of the Inceptisol soil that was determined by titration in acidic medium soil was 3.3% per gram soil samples [1].

IV. CONCLUSION AND SUGGESTIONS

A. Conclusion

Dustfall concentration in ambient air was 8.6 ton/km².month for field measurement and 11.1 ton/km².month for laboratory scale experiment. Dustfall generation was positively correlated with wind speed and negatively correlated with soil moisture content. The fittest mathematical model to predict dustfall generation [Y] over an area of Inceptisol soil as influenced by wind speed was $Y=8.87x^2-2.34x+5.198$ where "x" denoted the wind speed over the land. The prediction model as influenced by moisture content was $Y=259.1-11.73x$ where "x" represents the soil moisture content. The result of the experiment indicated that dustfall concentration in ambient air was strongly influenced by soil moisture content.

B. Suggestions

1. The next research should be carried out on the other main soil types commonly found in Indonesia, i.e. Ultisol, Andisol, Vertisol and Entisol.
2. Other meteorological factors such as relative humidity, temperature and sunshine intensity need to be taken into account in determining the dustfall generation from the soil surface.
3. The influence of soil texture, organic-C content and the percentage of land cover on dustfall generation needs to be studied so that the analysis of the correlation between these factors become more comprehensive.

ACKNOWLEDGEMENT

The authors wish to acknowledge the ISS 2013 for the bulk of this guide.

REFERENCES

- [1] C. Airoidi, S.A.M. Critter, "Brazilian re Inceptisol a typic soil as an exchanger: thermodynamic study involving Cu, Zn, Cd, Hg, Pb, Ca and Na," *Clays and Clay minerals*, vol. 45, no. 2, pp. 125-131, 1997.
- [2] E.A. Akpınar, S. Akpınar, H.F. Öztoğ, "Statistical analysis of meteorological factor and air pollution at winter months in Elazığ Turkey," *Journal of Urban and Environmental Engineering*, vol. 3, no. 1, pp. 7-16, 2009.
- [3] F.Fecan, B. Marticorena, G. Bergamett, "Parametrization of the increase of the aeolia erosion threshold wind friction velocity due to soil moisture for arid and semi-arid areas," *Annales Geophysicae*, vol. 17, pp. 149-157, 1999.

- [4] C. Hai, Yuan C, G. Liu, X. Li, F. Zhang, X. Zhang, "Research on the component of dustfall in Hohhot in comparison with surface soil components in different lands of inner Mongolia Plateau," *Water, Air, and Solid Pollution*, vol. 190, pp. 27-34, 2007.
- [5] I. Koren, Y.J. Kaufman, "Direct wind measurements of saharan dust events from terra and aqua satellites," *Geophysical Research Letters*, vol. 31, no.6, art. No.-L06122, 2004.
- [6] L.Y. Liu, P.J. Shi, S.Y. Gao, X.Y. Zou, H. Erdon, P. Yan, X.Y. Li, W.Q. Ta, J.H. Wang, C.L. Zhang, "Dustfall in China's Western Loess Plateau as influenced by dust storm and haze events," *Atmospheric Environment*, vol. 38, pp. 1699-1703, 2004.
- [7] G. McTainsh, C. Strong, "The role of aeolian dust in ecosystems," *Geomorphology*, vol. 89, pp. 39-54, 2007.
- [8] R.P.C. Morgan, *Soil Erosion and Conservation*, Hong Kong: Longman Group, 1998.
- [9] K. Naddafi, R. Nabizadeh, R. Soltanianzadeh, M.H. Ehrampoosh, "Evaluation of dustfall in the air of Yazd," *Iran. J. Environ. Health*, vol. 3, no.3, pp. 161-168, 2006.
- [10] Nandi, I. Luffman, "Erosion related changes to physicochemical properties of Ultisols distributed on calcareous sedimentary rocks," *Journal of Sustainable Development*, vol. 5, no. 8, pp. 52-68, 2012.
- [11] R.Y. Niu, Z.J. Zhou, Y.W. Liu, Y.Q. Yang, "Causes of abnormal decreasing of dusty weather in China during the spring of 2003," *Climatic and Environmental Research*, vol. 9, no. 1, pp. 24-33, 2004.
- [12] Peraturan Pemerintah No. 41 Tahun 1999 about Pengendalian Pencemaran Udara.
- [13] Z. Shang, L. Cheng, Q. Yu, L. He, Z. Lu, "Changing Characteristics on Dust Storm in Jiangsu," *Open Journal of Air Pollution*, vol. 1, pp. 67-73, 2012.
- [14] SNI 13-4703-1998 about Penentuan Kadar Debu di Udara dengan Penangkap Debu Jatuh (Dustfall Collector).
- [15] Soil Survey Staff, *Keys to Soil Taxonomy*. Washington DC: World Soil Resources Staff, Natural Resources Conservation, 1998.
- [16] Sugiyono, *Statistika untuk Penelitian*, Bandung: Alfabeta, 2011.
- [17] S. Sukartaatmadja, Y. Satol, E. Yamaj, "The effect of rainfall intensity on soil erosion and runoff for Inceptisol soil in Indonesia," *Bul. Agron*, vol. 31, no. 2, pp. 71-79, 2003.
- [18] R. Washington, M.C. Todd, N.J. Middleton, A.S. Goudie, "Dust storm source areas determined by the total ozone monitoring spectrometer and surface observations," *Annals of the Association of American Geographers*, vol. 93, no2, pp. 297-313, 2003.
- [19] M. Yoshioka, N.M. Mahowald, J.L. Dufresne, C. Luo, "Simulation of absorbing aerosol indices for african dust," *Journal of Geophysical Research*, vol. 110, D18, art. no.D18S17, 2005.
- [20] X.L. Zhou, "Discussion on some terms used for sand dust weather in the national standard," *Scientia Meteorologica Sinica*, vol. 30, no. 2, pp. 234-238, 2010.