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and The Council of University President of Thailand (CUPT)

"EXPLORING RESEARCH POTENTIALS"

Editors:
A. Muslim (Indonesia); Siti Herlinda (Indonesia); Nurly Gofar (Malaysia);
Melanie Boursnell (Australia); K.T. Tantrakarnapa (Thailand);
Judhiastuty Februhartanty (Indonesia); Misnaniarti (Indonesia);
Najmah (Indonesia); Suci Destriatania (Indonesia)

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FOREWORD

Dear special guests:

Minister for National Education, Ambassadors of Thailand for Indonesia, Ambassadors of Indonesia for Thailand, all delegates from The Council of Rector of Indonesian State University (CRISU) and The Council of University President of Thailand (CUPT), Government of South Sumatra and Palembang City, and all The 6th CRISU-CUPT Conference, International Seminar and Exhibition participants

On behalf of the Sriwijaya University as Host University, I would like to extend my warmest welcome to all of the participant of The 6th CRISU-CUPT Conference, International Seminar and Exhibition, held on 20th-22nd October 2011 at Sriwijaya University Palembang with the join theme "Exploring Research Potentials".

There will be many challenges and opportunities in higher education in the Asean Community in the next decade. This is, therefore, considerable significant will arise from the The 6th CRISU-CUPT Conference, International Seminar and Exhibition. The previous five CRISU-CUPT conferences have been sigficantly deepening the relationships and come up with very fruitfull discussion in various subjects of collaboration and cooperation, for example, global warming, global mobility, academic interaction and cross-fertilization. The 5th conference was held in Chiang Mai, Thailand on July 7th-9th 2010 and appointed Sriwijaya University as a host for the 6th conference.

The 6th CRISO-CUPT conference will include many agenda, with not only include the meeting of the President Forum, the Dean Forum, and the Student Forum, but also will include international Seminar and Exhibition. This conference, therefore, might come up with more fruitfull conclusion and deepest commitment among participants.

With regard to considerable conference agenda, we greatly appreciate any support and sponshorship derived from any govermental as well as private institutions for the success of the conference. Great appreciation is also handed to organizing committe of the conference for any voluntarily effort that bring to the succes of the conference.

The 6th CRISU-CUPT Conference, International Seminar and Exhibition is being attended by about 600 participants. I hope you enjoy the beauty of Palembang City as one of the oldest city in Indonesia which is 1318 years old, established during the glory of the vast Sriwijaya Kingdom. The city also have variety of interesting culture and places.

Palembang, October 2011
Chairperson,

Prof. Dr. Badia Perizade, M.B.A
Rector of Sriwijaya University

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BIOPHYSICAL CHARACTERISTICS OF TAILINGS DEPOSITION AREA AND ITS CONTRIBUTION TO VEGETATION GROWTH

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ABSTRACT

Land characteristics associated with the growing requirements of plants. Physics research to study the character of land tailings deposition is performed to determine its condition to the growth of vegetation has been done. Mining activities will result in the form of sludge disposal is known as a tailings sand. To produce about 3-4% concentration of metallic minerals (copper, gold and silver), PT Freeport in Papua spends about 96-97% tailings. Tailings are discharged and deposited in a special area who engineered the deposition called ModADA (Modified Ajkwa Deposition Area). Tailings deposition causes changes in the ecosystem and affect the characteristics of the land, as well as affecting the diversity of vegetation growing. Research conducted in separate areas in ModADA where biophysical conditions of the region has envolved as a natural revegetation and reclamation. Methodology used is a method of using Landsat survey to determine the sampling point. Soil sample taken at 0-30 cm depth by drilling to a depth of 120 cm. Location decision based on the density of vegetation. Soil texture, drainage, effective depth, and soil color is a land of physical parameters were observed. The results showed that the biophysical characteristics of tailing deposition area affecting vegetation growth. Factor of water avaibility, rooting conditions and retention of nutriens become the limiting factor for the growth of vegetation on the tailing deposition area.

Keywords : *biophysical characteristics, tailings*

INTRODUCTION

Tailings are the end product processing in the host rock in mining activities. PT Freeport Indonesia in Papua produces tailings as a result of the final separation of the host rock of valuable minerals such as copper, gold, and silver. Tailings from a height of 2800 m above sea level is discharged through the river system Aghawagon-Otomona-Ajkwa to specific deposition areas in the lowlands Ajkwa called MoDADA (*Modified Ajkwa Deposition Area*) (PTFI, 2008). In MOdADA that are inactive for about 8-25 years with an area of ± 1500 ha, and currently serves as an area of natural succession and reclamation area called Double Levee. A second difference is the condition of the area and water depth distribution of the tailings particles. Area succession has a depth of shallow groundwater (<50 cm) and covered only the natural vegetation, while the reclamation area has water depths (> 100 cm) which had been planted vegetation in agricultural and forestry cultivation ordered (Taberima, 2009).

Land cover changes caused by the tailing of biophysical conditions, reduced fertility and relieve of nutrients from land. As a result, its ability to grow crops, low to cause loss or alternation of vegetation communities of origin to form another community. Environmental changes are real or significant change in the interaction between the constituent organisms lead to declining productivity of land ecosystems because it is not the growth of plants (Jordan, 1985).

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Plant environment is a complex system and is always interacting with the factors that influence each other, so the vegetation is dynamic and always experiencing change. Changes occur during the succession followed the productivity of vegetation (Barbour et al., 1999). Extreme conditions can be changed or modified to be the optimum conditions for plant growth. Ritung et al. (2007) stated vegetation grows well in a land where there is a match with field conditions. Soil biophysical conditions is a requirement to grow crops.

Tailings have different soil characteristics of soil minerals generally. Dominated by particles of sand tailings soil with little clay, so that low fertility. Barbour et al. (1999) stated that texture, nutrients, and depth is an important component in determining the relationship of competition and the rows of plants growing in different environmental conditions. In reality, not all species have similar nutrient requirements to produce a biomass of the same size. For survival, the species usually grow in nutrient poor environments have a high nutrient utilization. In order to manage and utilize land tailings to the maximum, then it should consider the suitability of land with plants. Based on the research conducted to study the biophysical characteristics of land tailings in relation to the process of revegetation.

METHOD

The study was conducted in May-August 2009 in the area on the ordinate 136o45'00 Embankment Ganda "-137o07 '00" BT and 04o20'00 "- 04o55'00" LS. Doubloe levee with an area separate from the 1500 ha and is relatively inactive tailings areas have stabilized. Vegetation growth differentiated the natural succession and reclamation areas, with vegetation age 4-25 years. Division of sampling blocks at the study site is determined based on the development of vegetation. Rainfall is high (375 mm / month), with the wet months of the year and an average of 22 days of rainy days per month, as well as ± 26oC temperature and humidity of 75-82%. Primary data includes qualitative and quantitative data. Qualitative data include vegetation data and quantitative data including soil physical and chemical data obtained through field and laboratory research. While the secondary data (topography, meteorology, Landsat imagery, and supporting data field) is obtained from the company.

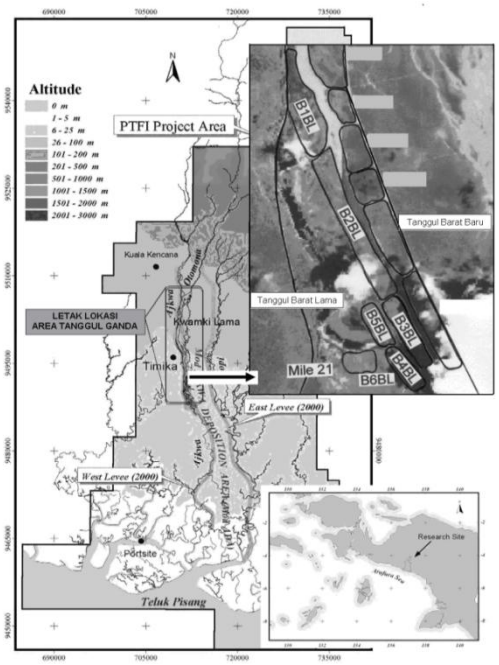

Figure 1. Location of the Double Levee area on Freeport's concession

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The research method using descriptive method quantitative and qualitative descriptive. The determination based on the purposive sampling methods and field observations. The research area is divided into 18 blocks, consisting of 6 blocks in the Old West levee, 11 blocks in the New West levee using the transect method. The distance between the transect line and the maximum line length of each transect was 200 m. For each block is made transect lines that ran to the west-east or north-south direction following the vegetation conditions. The number of transect lines depending on the area blocks between 2 to 10 transects along the line. The method a modified of Indriyanto (2006).

Environmental data of land observation includes physical and chemical. Soil sample is a composite sample for each transect, taken from the 3 points in a plot (base, middle and end). Soil samples taken from surface soil to a depth of 30 cm of 250 g/plot. Then the soil sample is mixed with soil samples from other plots on one transect with the same point until homogeneous. Then the composite soil samples were taken of 500 g for the physical and chemical soil analysis. Soil physics data include texture, porosity, particle size distribution and permeability.

RESULT AND DISCUSSION

Observation of climate conditions during the years 1998-2009 is known that the average air temperature in the Mimika region is 26.42 ° C with air pressure ranges from 1005,53 to 1015.42 Mbs. The average rainfall is 334.57 mm rain per month and wet every month, and 84.91% humidity is highest in July. The climatic conditions affect the condition of the tailings deposition area, and to moisture and hydrological cycle. Double Levee have indicated low levels of fertility. Effect on alkaline soil available P and low micro elements. The content of N, P, K and organic matter are very low. Sand fraction (16.4 to 94.7%) higher than the clay (0.4 to 13.2%) led to a low CEC value so difficult to bind the soil of nutrients and elements easily lost due to run off or leaching. Therefore, the ability to grow plants on the tailings deposition area Levees tend to be low-double. This is evidenced in the absence of vegetation in some areas in the dykes Double or vegetation of high diversity in other areas (Windusari et al., 2009).

According to Schafer et al. (1980) in Taberima (2008), soil formed from the tailings have a real difference in morphological appearance. Land is a young land consisting of a heterogeneous mixture of fragments of sand, dust, and a little clay. The development of a layer or horizon in the area of tailings is more human than in the control of natural processes. This suggests that the vegetation succession that occurs on land tailings reclamation occurring faster than naturally.

Opinion was supported by research showing that the diversity of species in the area of reclamation areas tend to be higher than the natural succession (Windusari et al., 2010). Physical characteristics of the tailings vary in terms of particle size (coarse sand, medium, fine to dust) and texture. Freeport (1998) divides the particle size of tailings into 4 groups: coarse particles (size> 175 μ), medium particles (size 175-150 μ), fine particles (size 38-75 μ), and very fine (size <38 μ). Due to the gravitational influence of the tailings particles that settle gradually. Particle size of the coarse tailings settles first in the upper ModADA, then followed by medium and fine particle size in the downstream (Husin & Susetyo, 1999).

Tailings have a lot of mineral deposits and affect the process of soil formation. According Taberima (2009), tailings double levee area undeveloped to the maximum and has only a thin layer of horizon A. Rochim (2003) menyatakann development of structures typically found in the surface layer or top soil.

High rainfall (3500-4000 mm / year), temperature (25 - 27oC) and moisture (> 90%) at study sites to accelerate the process of formation of tailings into the ground. Soil formation first occurs in the south than the northern double levee. Tailings in the southern region of double levee has aged more than 20 years, whereas in the northern region was about 10 years.

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Table 1. Results of Measurement Chemistry Parameters and Percentage of Particles Soil

Block	pH soil	N-total (%)	P (ppm)	K (me/100 g)	Na (me/100 g)	Ca (me/100 g)	Mg (me/100 g)	KTK	C-org (%)	Percentage of particle size (%)		
										<2 µm	2-53 µm	53-2000 µm
B1BL	7.87	0.10	4.88	0.19	0.23	5.32	1.55	6.81	0.63	3.08	42.64	54.24
B2BL	7.72	0.08	7.63	0.20	0.25	5.92	1.92	5.40	0.64	6.16	66.28	27.56
B3BL	7.90	0.11	9.81	0.18	0.28	10.84	2.58	9.04	0.92	3.54	56.04	40.46
B4BL	7.96	0.07	6.65	0.17	0.24	2.79	2.31	6.67	0.73	5.47	59.00	35.50
B5BL	7.89	0.08	7.17	0.12	0.20	9.28	1.62	6.10	0.65	0.77	14.07	85.17
B6BL	7.83	0.12	7.45	0.20	0.27	15.64	1.98	7.43	1.04	5.45	63.40	31.10
B1BB	6.59	0.06	4.91	0.13	0.17	2.88	0.96	6.35	0.44	1.50	22.60	75.90
B2BB	6.95	0.07	6.52	0.18	0.31	9.53	1.83	2.85	0.60	0.35	4.75	94.90
B3BB	7.50	0.02	3.89	0.12	0.19	4.92	0.53	1.73	0.21	2.40	47.90	49.70
B4BB	7.50	0.05	3.72	0.20	0.24	2.05	1.58	2.26	0.44	3.70	66.55	29.75
B5BB	7.37	0.09	5.92	0.17	0.45	6.21	1.44	3.88	0.67	3.40	41.20	55.35
B6BB	7.84	0.06	4.82	0.16	0.31	4.95	1.19	3.02	0.58	6.15	70.25	23.55
B7BB	7.71	0.08	3.89	0.18	0.50	6.95	1.06	4.09	0.65	4.55	75.90	19.55
B8BB	7.74	0.05	4.49	0.17	0.24	7.70	0.93	3.55	0.49	10.5	57.20	32.25
B9BB	7.66	0.08	4.70	0.22	0.41	11.29	0.95	4.39	0.61	6.82	52.08	41.08
B10BB	7.70	0.10	4.67	0.23	0.53	11.67	1.58	7.66	0.94	4.16	38.67	57.19
B11BB	6.25	0.05	5.68	0.06	0.16	1.63	0.57	3.72	0.22	0.79	9.00	90.19
Rata2	7.53	0.07	5.69	0.17	0.29	7.62	1.44	5.00	0.61	4.05	46.33	49.61

Observations show that soils has a texture ranging from sand to sandy loam. Old West area tend to be dominated by sandy loam texture of the tailings and characterize the deposition process is longer. The diversity of vegetation species was higher in the region also shows the development of better.

Sandy loam texture dominating double levee. This texture effect on drainage. Drainage conditions on the size of the coarse tailings area better and tend to dry compared to the size of the fine tailings area. The color of the soil were analyzed showed flooded region. This is related to the condition of roots and utilization by vegetation. The results show the color of the soil in the area of deposition varied. The color of the soil layer below a feature to determine the condition of drainage. Gray on the bottom layer indicates poor drainage, while the brownish yellow color indicates good drainage.

The observations show that the condition of the groundwater in the area of research is high ranging between 40-79%. Poor drainage puddles affected due to rains, overflowing rivers or water seepage from the levee that borders ModADA. Groundwater conditions affect vegetation. Commonly flooded areas overgrown with vegetation that is tolerant of saturated water. Pioneer vegetation like *Phragminthes karka* is the dominant vegetation communities in the region.

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Table 2. Data Land Drainage, Soil Texture Class, Effective depth, and soil pH

Block sampling	Drainage	Soil texture	Effective depth (cm)	Soil pH
B1BL	Baik	Lempung berpasir	120	6,69
B2BL	Baik	Lempung berpasir	120	8,68
B3BL	Agak buruk	Pasir berlempung	60	8,13
B4BL	Cukup Baik	Lempung berpasir	120	7,94
B5BL	Buruk	Pasir	60	7,91
B6BL	Agak buruk	Lempung berpasir	80	7,93
B1BB	Baik	Pasir berlempung	80	7,37
B2BB	Agak buruk	Pasir	80	7,13
B3BB	Agak buruk	Pasir berlempung	120	7,48
B4BB	Agak berlebihan	Lempung berpasir	120	7,55
B5BB	Agak berlebihan	Lempung berpasir	120	7,16
B6BB	baik	Lempung berdebu	120	7,80
B7BB	buruk	Lempung berdebu	120	7,70
B8BB	Sangat buruk	Lempung berdebu	20	7,74
B9BB	Buruk	Lempung berdebu	120	7,67
B10BB	Agak buruk	Lempung berpasir	80	7,70
B11BB	Baik	Pasir	120	7,38

Based on these results, confirmed that the soil tailings have very different characteristics than the general soil minerals. Low fertility rates become obstacles in the process of revegetation on land tailings, so its management must be appropriate and suit the conditions of land. The presence of various types of vegetation in the area of tailings deposition double levee indicated that the development of land in the area and changes in the biophysical characteristics of the tailings area to support the growth of plants. Changes in biophysical characteristics of land associated with the cessation of tailings deposition process. The statement was supported by the opinion of Uhl et al. (1988) which states that the process of colonization of pioneer species may occur in nutrient-poor areas where land degradation does not continue.

CONCLUSION AND SUGGESTION

Conclusion

Based on the results of the study concluded that the growth of vegetation on the tailings deposition area influenced by several factors such as availability of water, plant roots, and nutrient retention. Due to the influence of these factors, then some parts of the study area is overgrown with vegetation or vegetation grown slightly, while in other parts of vegetation growing very well.

Suggestion

Despite the development of natural vegetation can grow well in the area of tailings deposition, but to do the revegetation of land reclamation should be considered plants in accordance with the conditions of land.

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