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Double Master Degree Program on Integrated
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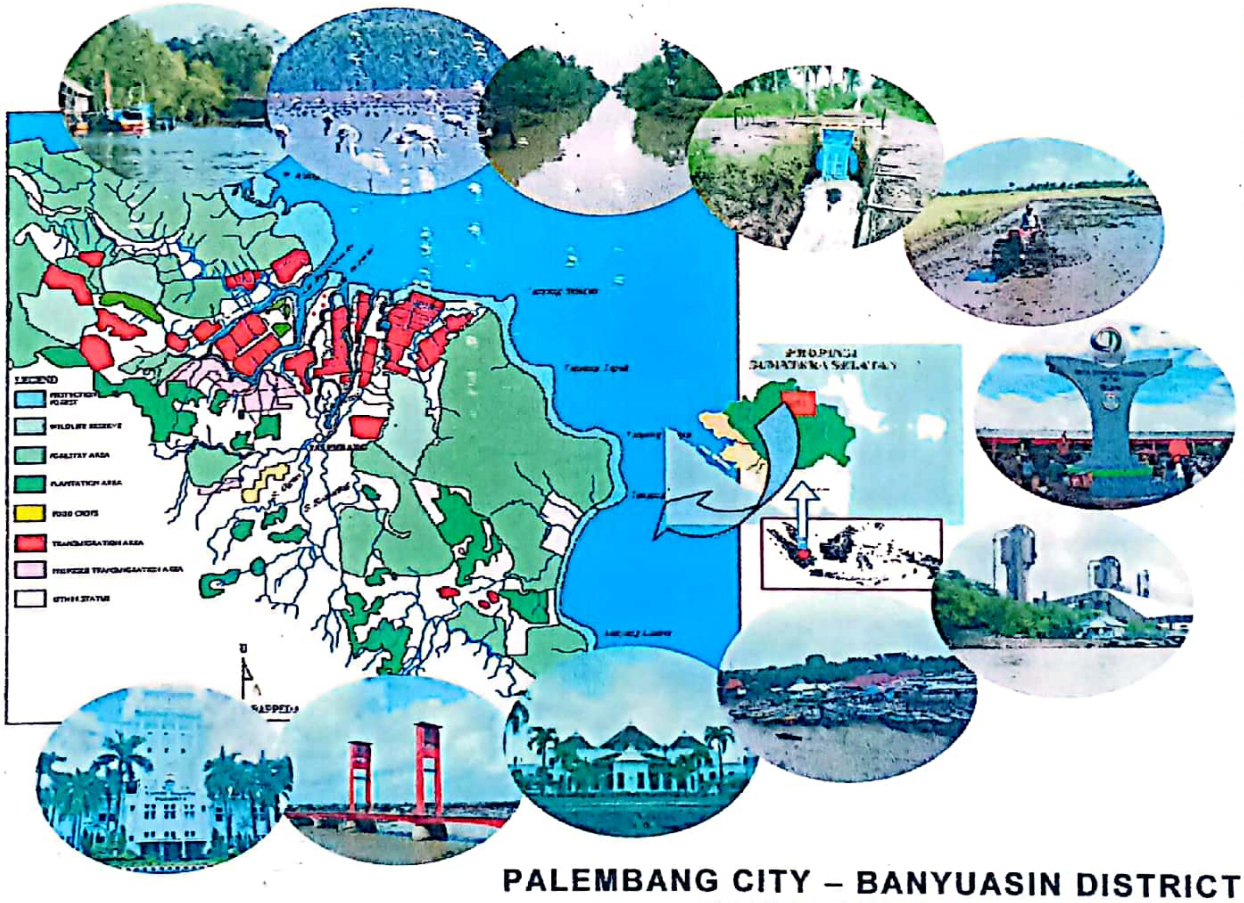
Proceedings

INTERNATIONAL SEMINAR-WORKSHOP ON
"INTEGRATED LOWLAND DEVELOPMENT AND MANAGEMENT"

THEME:
THE ROLE OF AGRO-ECO-EDU PROGRAM THROUGH MULTISTAKEHOLDERS PARTICIPATION ON THE SUSTAINABILITY OF LOWLAND DEVELOPMENT AND MANAGEMENT



PALEMBANG CITY – BANYUASIN DISTRICT
SOUTH SUMATRA - INDONESIA
MARCH 18 – 20, 2010

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FOREWORD

Lowland areas consist of swampy areas, wetlands, coastal areas, saturated and high water table areas in the sides of rivers or estuaries.

Hydrologically these lowland areas are defined as upland swamps (lebak) when the high water table condition is affected only by the rainfall and the surface run off in the watershed. On the other end, it is named tidal lowlands when affected by the tidal movement, either directly or indirectly interact with the river flow. Mineral soil, deposited sediment, or peat are material which formed the land with these high water table condition. Mega biodiversity within the wetlands and coastal areas are of concern in the management and development of lowlands.

Some suitable lowlands areas are developed for living of the people since hundreds of years ago, ie. Bugineese, Banjarees people development for paddy field and aquaculture system. This community based development triggered the government of Indonesia since 1969 to develop a transmigration program for food crops production. Estate crops development mostly by the private sector - agro industry based development - has started to work on the lowlands.

If we look on different perspectives, both conservation and development of the lowlands should be considered. Integrated lowland development and management is one of the key issues need to be addressed.

International Seminar-Workshop is theme The Role of Agro-Eco-Edu Program through Multistakeholders Participation on the Sustainability of Lowland Development and Management. International Participants are from Netherlands, Thailand, Malaysia.

International Seminar and Workshop committees wish to gratefully acknowledge the support extended by the Sponsors. Committees are also indebted to all those who have kindly helped in the preparation of these proceedings and deeply grateful to the Authors, for their valuable contributions in the form of papers.

Palembang, South Sumatra, Indonesia, March, 2010
Chairman of the Organizing Committee

Dr. Robiyanto Hendro Susanto, M.Agr.Sc

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AN ANALYSIS OF THE WATER OF TELANG RIVER, GASING RIVER AND LIQUID WASTE OF INFLUENT,EFFLUENT AGROINDUSTRY IN BANYUASIN

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ABSTRACT

South Sumatera is one of the provinces in Indonesia that has various potential sources of agricultural products, such as coffee, rubber, palm oil, etc. In the development program of Tanjung Api-Api harbour region, the government provides areas for various industries, especially agricultural industry. This agricultural industry must have some effects in the future. The industrial area is located in the subdistricts of Muara Telang and Banyuasin II, which is close to Telang River with many streams, a large natural forest and wildlife that still need to be protected. Sample water was taken from some spots of Telang River and Gasing River, and influent and effluent installation of Gasing's industry. The results showed that BOD parameter at the downstream of Talang River reached 4.12mg/l at low tide and 2.01mg/l at high tide. The results of Gasing River showed that its TTS, BOD and fat oil were quite high. TTS parameter analysis at Water Waste Treatment Installation inlet was 481mg/l and BOD 4046mg/l, resulted from palm industry. TSS parameter at installation outlet of rubber industry was 125mg/l and BOD 64mg/l.

Key words : agroindustry, organic and anorganic waste

INTRODUCTION

Tanjung Api-Api developmental industrial area is a stretch of marsh which is geomorphologically a big delta resulted from the activities of Banyuasin River and Telang River; therefore, the area is known as *Delta Banyuasin Telang*. Tanjung Api-Api industrial area borders in the west on a reservation, and the present ecosystem is considered good, rich in flora and fauna. The data from the Forestry Planology Agency based on the research by the Institute of Forestry Maintenance Region II, Report of West Coastal Forest Preserve, Banyuasin Regency, South Sumatra Province, 2005 show that there are still various natural mangrove forests with various kinds of animals, such as gibbon, monkeys, wild boar, stork, tigers, and dogs. Most of the preserve region has been open, which makes the identification process difficult. Future industrial development will create potential problems, such as a decrease in fresh water reserve and quality because of a change in hydrological cycle. The development of industrial area should also consider the area limit to avoid potential conflicts in the developmental area, which will have a direct effect on the preserve region. It should be noted that the industrial area will closely relate to Tanjung Api-Api Harbour and its environment. Every industrial development will have some regional issues, such as an increase in population, socioeconomic and sociocultural

conflicts, and pollution such as degraded river because of liquid waste. Mangrove forest near the river should be protected from industrial liquid waste. Forest destruction may result from the industrial waste or suspended solid substance disposed by various agro-industries. Dangerous liquid waste from agroindustry's Water Waste Treatment Installation may be organic or anorganic. The typical liquid waste can be physically observed, such as emitting bad odor (stink), having brown to black color, and oily. Solid-forming waste will become sediment on the bed of the river receiving the waste. Some important parameters are BOD, COD, TTS, fat oil, and pH.

This research will become a reference to solve cases of liquid waste from upstream to downstream agroindustry in tidal wet land conditions. This research will produce a model design of agroindustry liquid waste integrated treatment. Waste-treatment entry data will be collected from the present industries available in South Sumatra, especially the Regency of Banyuasin. The industries are selected on the basis of similar conditions of land and rivers receiving liquid waste approximately the same amount as those in Gasing agroindustrial area. The research sample is taken from the present Gasing's Water Waste Treatment Installation. The purpose is to find out whether the present operating Water Waste Treatment Installation still produces liquid waste above the quality standard, what the value of disposed waste is, and how much liquid waste is disposed by each industry. All these data will be used to calculate material balance in the treatment.

The research is limited to analyzing organic liquid waste parameters, such as BOD, TTS, pH, and anorganic substance like fat oil affecting the environment of Telang River, Tanjung Api-api region, and Gasing River, also analyzing liquid waste of influent and effluent Water Waste Treatment Installation at several industries, such as rubber, palm and palm oil industries.

Prior to formulating and simulating effective and efficient treatment system model design by minimizing liquid waste at integrated Water Waste Treatment Installation for tidal wet land agroindustry, there should be a preliminary research: (1) to identify waste characteristics and analyze the potential environmental effects when the industries are in operation; the sample will be the present available similar agroindustry, (2) to predict the effects of waste treatment products on Tanjung Api-Api region and the rivers.

This research will give some contribution (1) to the development of science in building industrial area on wet land, and (2) to the government in making policy of building the industrial area.

LITERATURE REVIEW

1. Industrial Liquid Waste

Industry often produces polluting chemical compounds which can damage environment. Industrial waste can be solid, gaseous, and liquid. Liquid waste sometimes contains overlimited amount of organic, anorganic compounds, including heavy metal. A standard from BMLC based on the South Sumatra's Governor Regulation No. 18/2005 is used to monitor whether the quality of liquid waste is beyond the threshold.

The chemical characteristic of liquid waste containing organic compounds is carbon combined with one or more other elements, like O, N, P, and H. In water, its pH lowers toward acidity; usually organic substance increases and it releases CO_2. Organic substance is mostly found in mud, and mud break downs slowly so the organic substance is not degraded. Some parameters of organic liquid waste from agroindustry are as follows: (a) Parameter of oil and fat which are ester compounds, alcohol formation of carbon, hydrogen and oxygen. Fat is not easily broken down by

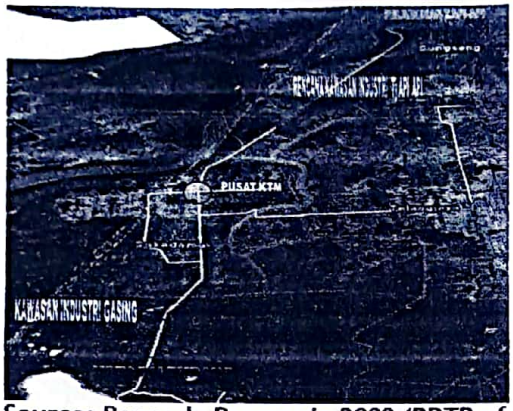
bacteria, but it can be hydrolized by alkali to form soap compound which is easily dissolved. Oil in water can be resulted from various sources, such as waste from the industries of rubber, tires, remiling, rubber houseware, coconut oil, soap, detergent, coffee, fertilizer, and lubricating oil from natural crude oil used for cleaning (Kristanto, 2006: 83-84). (b) Parameter of phenol in liquid waste is not limited to this phenol (C_6H_5-OH), but also the phenol with a concentration of 0.005/liter in drinking water which has some taste and odor when reacted with chlor to form chlorophenol. The sources of phenol are from treatment industry, plywood industry, rubber industry, like tires and remiling (Ginting, 2007: 110).

The chemical characteristic of liquid waste containing anorganic compounds is all combinations of elements not formed by organic carbon. Anorganic carbon in liquid waste generally consists of sand, grit, and minerals, both suspended and dissolved. Some parameters of anorganic waste found in agroindustry are among others: (a) *phosphate* from industries of soap, detergent, coconut oil, palm oil. A high content of *phosphate* is good for algae and other organisms. This substance is mostly from cleaning material containing *phosphate* compounds (b) Sulphate from rubber industry and the like. Sulphur in large amount will increase the acidity of water. Sulphate ions can be formed naturally. Sulphur dioxide is needed in synthesis. (c) Nitrogen in liquid waste can form ammonia with the help of bacteria; algae and other plants use nitrogen to form protein, and animals also use nitrogen to form animal's protein. Bacteria damage protein to produce ammonia. Nitrit shows the amount of oxidized nitrogen. This nitrogen is often found as nitrogen nitrit. This parameter is from industries of tires, remilling, rubber houseware, palm oil, coconut oil, and plywood. (d) Ammonia is categorized into anorganic waste from industries of tires, *remilling*, cocunut oil and palm oil. Ammonia is the main product of nitrogen waste breakdown (decay), which indicates that there is a spoiling by the compound (Achmad, 2008: 102).

Some parameters of agroindustrial liquid waste on the basis of biochemical aspect by testing the content of oxygen in water are among others: (a) *Biochemical Oxygen Demand* (BOD), testing the demand of biochemical oxygen. BOD shows the amount of dissolved oxygen needed by living organism to break down or oxidize waste materials in water. (b). *Chemical Oxygen Demand* (COD), testing the demand of chemical oxygen. To find out the amount of organic materials in water, one can use a test faster than BOD, that is based on the chemical reaction of an oxidant material. (c) Acidity Measure: acidity can be measured with pH meter and is based on the concentration of hydrogen ions in water. Waste water with high or low pH becomes sterile water, and consequently kills microorganisms and other living things in water. Water with low pH becomes corrosive to construction materials like iron. Alkali (base) waste contains anorganic substance like carbonate compound, bicarbonate, and hydroxide. Acid waste derives from acid chemical substance, such as chloride acid, sulphate acid, etc. (Sakti, 2005: 21-23).

2. Environmental Conditions of Tanjung Api-Api Developmental Industrial Area

Tanjung Api-Api developmental industrial area is in the Regency of Banyuasin. The industrial area is near the harbour, Sumatra's east coast facing Bangka Strait or Java Sea, 68 km north of Palembang, geographically located on 02°,17[1] LS and 104°,50 BT (Profile of Tanjung Api-api Harbour, South Sumatra Province, 2005). The coast near Tanjung Api-Api is an estuary zone affected by tides, with sediment and coastal plants (mangrove, thatch palm, etc.). The following picture shows the location of the industrial area.



Source: Bappeda Banyuasin 2008 (RDTR of Tj Api-api Region)
Figure 1. Location of Tanjung Api-Api Developmental Industrial Area

Most of Banyuasin Regency is a coastal low land at the downstream of Musi River and Banyuasin River. Most of the area is used for wetland food agriculture, especially tidal rice cultivation. Tanjung Api-api region developed into industrial area in Banyuasin, South Sumatra, will have an effect on the ecosystem of neighbouring wet land, like the rivers, which may especially degrade the quality of rivers. (Bappeda, Banyuasin Regency, 2008. Detailed Plan of Layout of Supporting Areas of Tanjung Api-Api Harbour)

2.2. Some Agroindustry Groups

Agroindustry will dispose various kinds of liquid waste. Table 1 shows some parameters of liquid waste.

Table 1. Some Kinds of Agroindustries

JENIS INDUSTRI	LIMBAH FISIK	LIMBAH RGANIK	LIMBAH AN-ORGANIK
Ban dan *Remilling*	*Suspenson Soloid*	Minyak lemak, dan fenol	BOD, COD, nitrogen , chlor, ammonia, dll
Karet	*Supension Solid*	Minyak lemak, dan phenol	BOD, COD, nitrogen, chlor,, ammonia, dll
Minyak Kelapa	*Suspension Solid*	Minyak lemak	BOD, COD, ammonia
Kelapa Sawit	*Suspension Solid*	Minyak lemak	BOD, COD, ammonia
Sabun	*Suspension Solid*	Minyak lemak	BOD, COD, phosphat
Diterjen	*Suspensiion Solid*	Minyak lemak	BOD, COD, phosphat
Kopi	*Suspension Solid*	Minyak lemak	BOD, dan COD
Kayu *Plywood*	*Suspension Solid,*	phenol	BOD,COD, pH, dan ammonia.

Source: Ginting, 2007: 61 dan Utomo, 2007, journal

METHODOLOGY

1. Method of Approach

This research is conducted by using a scientific approach through inductive process. The scientific approach includes identifying problems, analyzing data and information, and clarifying data and drawing conclusions. The fundamental basis of industrial area near the harbour is the decision to do operational activities and the effects of liquid waste on the ecosystem, especially the rivers receiving the waste. This research is limited to the scope of environmental and chemical sciences related to the theory of river water analysis. The steps followed to solve the research problems are: (a) to obtain the data from the field of the initial conditions of the

rivers before the industrial development by using physical and chemical parameter tests, (b) to obtain the data of the present conditions of liquid waste disposed by the operating agro industries. The data can be obtained directly from the rivers; influent and effluent data from several industries' Water Waste Treatment Installations. The data needed are physical and chemical parameters.

2. Research Location, Time and Data

The research location is Tanjung Api-Api region in Banyuasin Regency, South Sumatra Province, and Gasing industrial area in Banyuasin Regency. Research location, time and data needed, both primary and secondary, are shown in Table 2.

Table 2. Research Location, Time and Data

RESEARCH LOCATION and TIME	PARAMETER DATA
Telang River in Tanjung Api-Api region, and parameter data investigated at the environment lab of Environment Agency, South Sumatra Province, July 2009	Data of some river spots as initial conditions 1. Physical; TSS 2. Anorganic chemistry; pH, BOD, dan COD 3. Organic chemistry; fat oil
At influent and effluent Water Waste Treatment Installations of some agroindustries, such as rubber, palm, coconut oil. Parameter observed at the lab of Environment Agency, South Sumatra Province (November-December, 2009)	Chemical Parameter Organic waste; fat oil Anorganic waste; pH, BOD, and COD Physical parameter; TSS

The research uses case method with location sampling determined. The research location is selected because Tanjung Api-Api region designed for industrial area has not been developed yet; therefore, this research could become a reference to cluster agroindustries into one area separated from non-agroindustry area. Besides, liquid waste treatment can be done integratedly and more efficiently so that installation outlets can dispose waste with suitable environmental quality standard. Gasing region is also selected as research location because its natural conditions are similar to those of Tanjung Api-Api region, and the majority of the industry is agricultural.

Research Method

This research is conducted in two stages: (a) identifying the characteristics of waste in Telang River and Gasing River, and (b) analyzing the debit of waste and dominant parameters at influent and effluent Water Waste Treatment Installations of several present agroindustries. The results of these two stages can be used to predict the factors influencing waste treatment products and environmental effects on the ecosystem of Tanjung Api-Api region, especially the rivers, if the similar kind of industry is developed in the future.

Research sampling method to obtain physical and chemical parameter data of Telang River and Gasing River is shown in Table 3, and that of influent and effluent Water Waste Treatment Installations data of Gasing region is in Table 4.

RESEARCH RESULTS AND DISCUSSIONS

As mentioned earlier, this research aims at providing a model design of integrated liquid waste treatment system and planned agroindustry conditions in Tanjung Api-Api region, a marsh near Telang River.

Research and Discussion 1

Data and Analysis of Industrial Conditions in Tanjung Api-Api Region

The data show that in the west of the developmental industrial area is Air Telang preserve, stretching along or parallel to the industrial area. The present ecosystem of the area is still good and rich in flora and fauna. Agroindustry liquid waste, if not treated properly, may have potential problems, like polluting the river. Tanjung Api-Api developmental industrial area is located in the subdistricts of Banyuasin II and Muara Telang. The industrial area in these two subdistricts borders on railways in the west and Telang River in the east. In the industrial area in the subdistrict of Banyasin II are Serangkap Tributary River, Batang Dalam Tributary River and Batang Stream, Pemanah Stream, Tengerak River, and other tributaries. In the east of the industrial area in the subdistrict of Muara Telang are Selayur Tributary, Candra River, Kemami River, Ringgit River and other tributaries. Agroindustry will dispose a lot of liquid waste. Organic liquid waste in the river will be degraded, where organic substances are broken down into ammonia. With the existence of oxygen in the air, aerobic process happens to convert ammonia into nitrit compound (NO_2), and later changing nitrit into nitrate compound (NO_3), which causes a decrease of oxygen in the water or oxygen deficit. This deficit will cause fishes and water organisms to die.

Data and Analysis of the Water of Telang and Gasing Rivers

Physical and chemical parameter data of initial conditions of Telang River were collected directly from several spots of Telang River. The data were analyzed at the environment lab of Environment Agency, South Sumatra Province, on 18 July 2009. Liquid waste parameter data from Water Waste Treatment Installations of some industries in Gasing and from Gasing River were also analyzed at the same lab in October 2009. Of the river water parameter data, only dominant parameters resulted from agroindustry are selected to be analyzed. Table 5 shows the data.

Table 5. Data of Telang River Water

DATA (UNIT)	RESULTS OF ANALYSIS						BMLC
	A	B	C	D	E	F	
Physical TSS, mg/l	16,3	11,9	18.6	15,6	20,3	10,9	50
K. An-Organic 1. pH, unit 2. BOD, mg/l 3. COD, mg/l	 6,36 2,93 9,70	 6.51 1,3 4,1	 6,13 1,12 6,35	 6,7 2,83 4,01	 6,68 1,08 8,10	 6,77 1,29 3,75	 6,0 2,0 10
K. Organic Fat oil, µg/l	500	300	500	200	500	300	1000

Note: (1) Telang River downstream: A low tide and B high tide, (2) Muara Telang River middle: C low tide and D high tide, (3) Telang River upstream: E low tide and F high tide

Table 6. Data of Gasing River Water

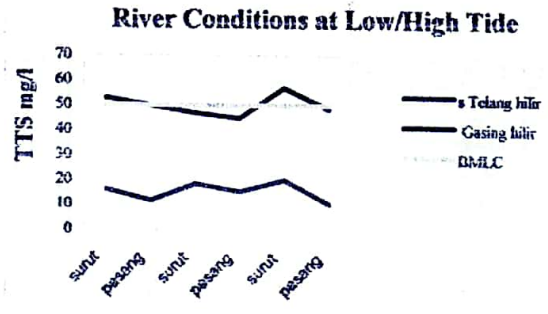
DATA (UNIT)	RESULTS OF ANALYSIS						BMLC
	A'	B'	C'	D'	E'	F'	
Physical							
TSS, mg/l	53	50	47	45	57,2	48,7	50
K. An-Organic							
4. pH, unit	4,46	4,84	4,73	5,23	4,68	5,75	6,0
5. BOD, mg/l	4,12	2,01	1,95	3,0	2,40	2,10	2,0
6. COD, mg/l	11,8	6,49	8,48	5,33	11,8	6,11	10
K. Organic							
Fat oil (M&L), µg/l	900	700	859	650	870	750	1000

Note: (1) Gasing River downstream: A' low tide and B' high tide, (2) Gasing River middle: C' low tide and D' high tide, (3) Gasing River upstream: E' low tide and F' high tide.

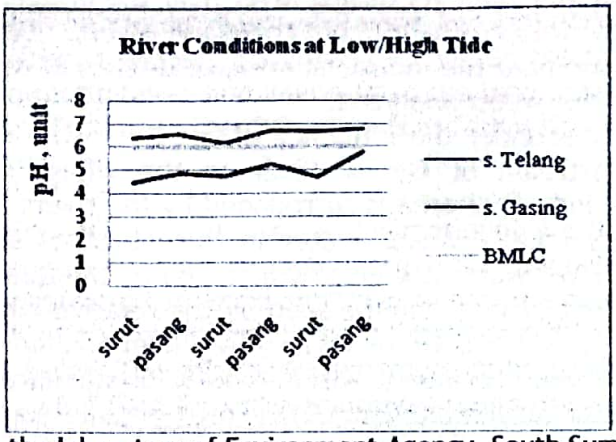
The data of Telang River water in Tanjung Api-api region in Table 5 are the parameter data of initial conditions of the river before the development of agroindustry in the future. The results of anaysis show that all Telang River physical and chemical organic parameters and chemical anorganic parameter have some values, but the values are still below the BMLC value limit. However, parameter BOD should be a concern because the value is 2.93 mg/l at the downstream of Telang River at low tide, and 2.83 mg/l in the middle of Telang River at high tide, where the BMLC limit is 2.0 mg/l. The values above the BMLC limit is due to the activities of the population living near Telang River who dispose organic waste into the river.

The data of Gasing River water show that some parameters have values approaching the BMLC value limit. Some other parameters have values above the BMLC limit, for example, TTS at the downstream at low tide is 53 mg/l, at high tide 50 mg/l, and at the upstream at low tide 57.2 mg/l, where the BMLC parameter standard is 50 mg/l. Fat oil at the downstream at low tide is 900 µg/l, at high tide 700 µg/l, whereas in the middle of Gasing River at low tide is 859 µg/l, at high tide 650 µg/l, where this parameter should not be higher than 1000 µg/l. The data show that fat oil parameter values are approaching the BMLC allowable limit. The high values are due to the fact that some industries have not operated their Water Waste Treatment Installations correctly.

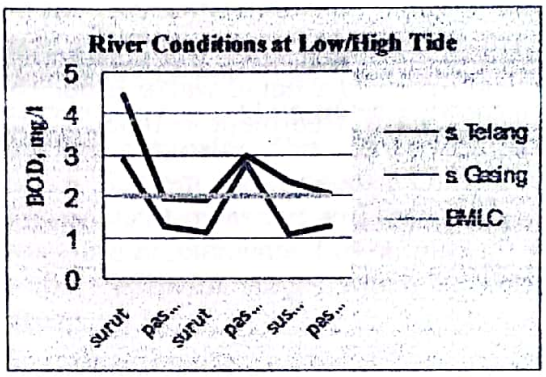
The data in Tables 5 and 6, the results of water analysis of Telang and Gasing Rivers at low/high tide are being compared to the parameters allowed by the South Sumatra's Governor Regulation No. 18/ 2005. Graphics 3 to 6 illustrate the comparison.



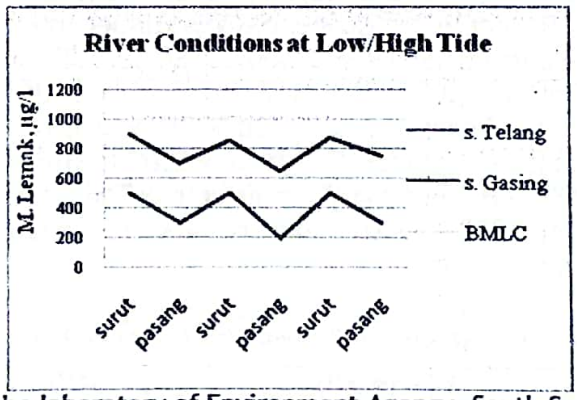
Analysis at the laboratory of Environment Agency, South Sumatra Province
Figure 3. Analysis of Parameter TSS



Analysis at the laboratory of Environment Agency, South Sumatra Province
Figure 4. Analysis of Parameter pH



Analysis at the laboratory of Environment Agency, South Sumatra Province
Figure5. Analysis of Parameter BOD



Analysis at the laboratory of Environment Agency, South Sumatra Province
Figuure 6. Analysis of Parameter Fat Oil

Parameters of river water quality in both industrial areas include a physical parameter (TTS) and chemical parameters (pH, BOD, fat oil). River water analyzed is that of Telang River and Gasing River at the downstream, middle and upstream. However, this research would investigate only Gasing River to get a picture of river conditions because (a) both areas have similar marshes, (b) both are affected by sea tides, (c) Gasing River has been heavily polluted because of the existence of Gasing industrial area, and (d) Gasing River flows into Musi River and into the sea through the river in Tanjung Api-api.

The industrial area is surrounded by two rivers, Gasing River in the west and Kenten River in the east. The two rivers meet in the northern industrial area, where there is a bridge as the border of the industrial area. From the northwest flows

Tanjung Lago River which meets Gasing River near the bridge. This research does not include analyzing water quality of tributary rivers, both natural unpolluted tributaries and those near the industrial area, or ditches in the industrial area. There are 6 samples of river water analyzed.

Gasing River is under the influence of sea tides. The tidal effect can be seen as far as the upstream of Gasing River in the village of Pangkalan Benteng. Therefore, Gasing industrial area is surrounded by the rivers influenced by sea tides. Besides, the rivers receive marsh water in the industrial area. Consequently, the characteristics of river water are heavily affected by the quality of marsh water and sea tides. The effect of tides can be seen by the relatively high value of TTS within 50-57.2 mg/l. Marsh water is characterized by a high organic content, low pH, thus a low content of oxygen. pH value is within 4.46-5.75 (standard value 6-9), BOD within 1.95-4.12mg/l (standard value 2 mg/l). A high organic content of marsh water is reflected by a high BOD value in the river water near the industrial area. The decomposition of a large amount of organic biomass will result in a low pH because decomposition forms acid organic substance. As the data give a low pH, then ammonia is not found.

The results of analysis on Gasing River will be approximately similar to those on Telang River if the future industry's liquid waste is not calculated. Therefore, there should be integrated water waste treatment installations to preserve the river.

Research and Discussion 2
Data and Analysis of Gasing

Agroindustry

Table 7 shows some sample industries in Gasing industrial area and the neighboring area. There are two discussions in this section. The first discussion aims at finding out how high is the output value from the water waste treatment installations of the 3 sample industries, namely rubber, oil and palm industries.

The second discussion is the mathematical calculation of material balance by using the data of liquid waste from installation inputs of the three industries as a test to calculate material balance of integrated water waste treatment. The purpose is to formulate and simulate a model design of waste treatment system in two stages: primary treatment and secondary treatment. The research was conducted in November-December 2009 with the results of analysis on several Gasing agroindustries as samples, as follows.

Table 7. Data of Waste Capacity and Parameter in Gasing Agroindustry

Q ,ton/hr	TTS (mg/l)			BOD (mg/l)			X
IPAL	*In let*	*Out let*	*Max*	*In let*	*Out let*	*Max*	*In let*
Rubber PT. X, 1600	187	25	100	2318	24,1	60	97.18
Palm PT Y, 603	481	220	250	4046	89,8	100	46.06
Coco Oil PT Z, 168	155	2,3	60	698	6,99	75	100.86
Total, 2371	823	129,3	-	7062	120,89	-	244.09

Parameter analysis at the laboratory of Environment Agency, South Sumatra Province

Analysis and Discussion on Liquid Waste of Gasing Agroindustry

Liquid waste from the inlet and outlet of waste treatment installations of some industries was directly taken and analyzed at the laboratory of the Environment Agency, South Sumatra Province. The discussion is as follows.

a. Palm Industry

The Palm Industry, PT Y, still uses a conventional waste treatment system, resulting in oil palm industry waste of high anorganic compounds because the waste contains a high concentration of solid material which needs more time to break down. Parameter TSS at the *outlet* reaches 202 mg/l and BOD 89.8 mg/l; both the parameters are just below the allowable maximum limit (see Table 7). The 2008 Monitoring Report on Banyuasin Regency environment quality states that in October 2007 this industry polluted ± 4.75 ha of rice fields belonging to the villagers of Lubuk Karet because of CPO.

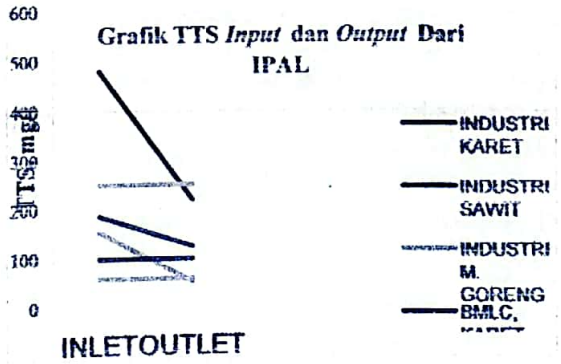
b. Rubber Industry

Technically the liquid waste quality of the Rubber Industry PT X is above the standard limit. This is due to the lack of installation maintenance. The technology of waste treatment is not new; it is the system of physical-chemical treatment but the installation does not function optimally. The TSS of installation outlet is 125 mg/l and BOD 64.1 mg/l; this is a problem and it needs a comprehensive solution to reach the BMLC limit. Some improvement measures and tests with the application of simple and inexpensive technology are recommended to obtain liquid waste below the BMLC limit. Picture 6 shows the treatment stages which include physical-chemical and biological treatment systems.

c. Coconut-Oil Industry

The Coconut-oil Industry PT Z disposes the result of liquid waste treatment into the waters. This will pollute the river any time if the waste treatment installation does not function properly. The results of the industry's waste monitoring show that TSS is quite high at 53 mg/l and BOD 69.9 mg/l. The management keeps improving the liquid waste treatment installation to meet the minimum standard required for liquid waste quality.

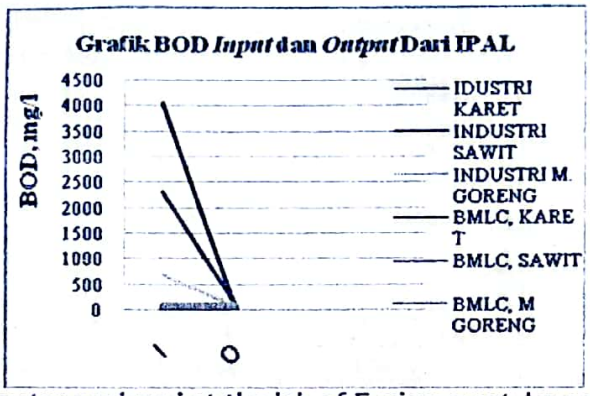
The following graphics show the values of TTS and BOD of the three simple industries, compared to the maximum level allowed by the Governor Regulation No. 18/2005.



Grafik TTS *Input* dan *Output* Dari IPAL

Parameter analyzed at the lab of Environment Agency, South Sumatra Province

Figure 7. Graphic of TTS at Agroindustry Installation



Parameter analyzed at the lab of Environment Agency, South Sumatra Province

Figure 8. Graphic of BOD at Agroindustry Installation

CONCLUSIONS AND SUGGESTIONS

Conclusions

1. Attention should be given to Telang River as there is a sufficient load of liquid waste into the river. Parameter BOD at the downstream of Telang River at low tide is 4.12 mg/l and at high tide 2.01 mg/l, where the BMLC limit is 2.0 mg/l. Although Telang River has not generally been polluted by agroindustry waste, the river at the downstream has been polluted as shown by a high BOD value. It can be concluded that there have been some activities by local residents in the area at the Telang downstream.
2. The results of analysis on Gasing River show some parameters for concern:
   a. Parameter TTS at the Gasing downstream at high tide reaches 50 mg/l and at low tide 53 mg/l; in Gasing middle at high tide is 45 mg/l and at low tide 47 mg/l; at the Gasing upstream at high tide 48.7 mg/l and at low tide 57.2 mg/l, where the BMLC limit of TTS is 50 mg/l.
   b. Parameter BOD at the Gasing downstream at high tide is 2.01 mg/l and at low tide 4.12 mg/l; in Gasing middle at high tide is 3.0 mg/l; at the Gasing upstream at high tide is 2.0 mg/l and at low tide 2.40 mg/l, where the BMLC limit of BOD is 2.0 mg/l.
   c. Parameter COD at the Gasing downstream at low tide is 11.8 mg/l; at the Gasing upstream at low tide is 11.8 mg/l, where the BMLC limit of COD is 10 mg/l.
3. Parameter fat oil at the Gasing downstream at low tide is 900 µg/l and at high tide 700 µg/l; in Gasing middle at low tide is 859 µg/l; and at the Gasing upstream at low tide is 870 µg/l and at high tide 750 µg/l, where the BMLC limit of fat oil is 1000 µg/l.

This indicates that Gasing River has been polluted by the industrial activities, especially agroindustry. The results of analysis can be used as a reference to initiate similar industrial development, especially integrated waste treatment installation, in Tanjung Api-Api region.

1. The results of analysis of parameters TTS and BOD at the inlet and outlet of installations of some sample industries show that parameter TSS is quite high at inlet 481 mg/l maximum and BOD 4046 mg/l maximum. This derives from palm industry with the waste debit of 603 mg/l at the installation. From the rubber industry, the waste debit at the installation is 1600 ton/day; and the parameter TSS is 125 mg/l, where the BMLC limit is 100mg/l maximum; and the parameter BOD is 64.1 mg/l, where the BMLC limit should be 60 mg/l maximum. This could

cause pollution any time if the waste treatment installation does not function properly.

2. All the data will be used in subsequent research to design a model of integrated liquid waste treatment system for agro industry in Tanjung Api-api region, and a simulation with the application of *software program Java.*

Suggestions

Some suggestions are offered as a contribution to the government in making a policy to build the industrial area in Tanjung Api-Api region:

1. It is suggested that agroindustry is placed in one area with an integrated water waste treatment installation so that the liquid waste disposed to the river can be controlled to meet the required minimum standard. This system is easy to control and creates mutual responsibilty to preserve the river receiving the liquid waste. The management should also keep operating and controlling the waste treatment installation properly so that it produces products meeting the required minimum standard.
2. There should be other variables to be analyzed, especially data of agroindustry's installation input from downstream to upstream, in order to design a better model of an integrated waste treatment installation. The variables of capacity parameters include Q, TSS, BOD, and solid concentration or microbe concentration.

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THEME:
THE ROLE OF AGRO-ECO-EDU PROGRAM THROUGH MULTISTAKEHOLDERS PARTICIPATION ON THE SUSTAINABILITY OF LOWLAND DEVELOPMENT AND MANAGEMENT

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