Preface

As part of a collaborative project between the Faculty of Engineering, Lambung Mangkurat University, German-Indonesia Chamber of Industry and Commerce (EKONID) and the Banjarmasin City Government to get field knowledge about waste management, we were asked to make a report on "Portrait of Basirih Landfill Condition Banjarmasin City: Problems And Solutions ". The basic purpose of this project report is to obtain information about the real condition of Basirih Landfill Banjarmasin City and to finding solutions in waste management in Basirih Landfill Banjarmasin City.

In this project report, we have included various waste data collection, analysis of waste composition, leachate analysis, effects, implications, and solutions for waste management in Banjarmasin City's Basirih Landfill.

Doing this project report helps us to increase our knowledge of work in the waste management system and be a great experience in the future.

Banjarmasin, August 21, 2019
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A. Introduction

Waste management has become an important issue because the amount of waste generated by the community continues to increase significantly. The development of industry in big cities from time to time is also one of the increasingly difficult factors for the existence of waste. Garbage has become a negative impact of activities in urban areas.

The volume of waste entering the Basirih Landfill in the city of Banjarmasin at present (July 2019) reaches 378.44 tons per day, with a population of 692,793 people. If it is assumed that the amount of waste currently measured is the same during 2019, the waste generated will reach 138,130 tons per year. The Basirih Landfill has a land area of 20 hectares, and has been used around 16 hectares (80 percent), so the rest is 20 percent. With the volume of waste reaching 138,130 tons per year, the Basirih Landfill capacity will continue to decline and will only be enough for the next few years.

 Basically, waste management is sorting, collecting, transporting, transporting, processing and final processing of waste. Therefore, the Banjarmasin City Government must have the right strategy to solve the waste problem. According to Law No. 18 of 2008 concerning Waste Management, in the notes to the Republic of Indonesia State Gazette of 2008 No. 69, it is explained that waste management is carried out based on the principles of responsibility, the principle of sustainability, the principle of benefit, the principle of justice, the principle of awareness, the principle of togetherness, the principle of safety, the principle of security, and the principle of economic value.

In 2019, the city of Banjarmasin cooperated with German-Indonesia Chamber of Industry and Commerce (EKONID) in the field of waste management. This collaboration aims to develop appropriate technology in waste management. Based on regional conditions, including population, climate, topography, and the current condition of facilities and infrastructure of the city of Banjarmasin, it is expected that this research can obtain appropriate waste management for the future and can be applied to the city of Banjarmasin. The Faculty of Engineering of the Lambung Mangkurat
University as the team requested by EKONID who tried to help one of these activities to conduct a brief study of the current condition of the landfill.

B. Purpose and Scope

The purpose of this activity is to help smooth cooperation between the Banjarmasin City Government and EKONID in developing waste management to get alternative solutions in waste management in the future.

The scope of work carried out by the team includes: recording and collecting data and information on existing conditions, sampling and tabulating data, physical, chemical and biological analysis, and possible recommendations. Implementation time lasts about 1 week, therefore the information collected may be very lacking. However, this simple information is expected to provide positive input for policy makers in the city of Banjarmasin in terms of waste management and processing technology in the future.

Based on the study conducted in a short time, the research team tried to collect data and information both visually and in laboratory analysis which included several things, including:
1. General conditions and waste treatment facilities; and
2. Analysis of liquid waste (leachate).

C. Method

1. Place

Observation and sampling of liquid waste (leachate) was carried out at the Basirih Landfill Site, Banjarmasin City, on April 24, 2019 (11:15 WITA). Samples were taken from 4 location points, namely Inlet (Location 1), Monitoring Well (Location 2), Outlet (Location 3), and Surrounding Environment (Location 4). Meanwhile for the composition of waste, samples are taken from about 10% of the garbage from trucks that transport waste from the Temporary Waste Storage (TPS) and then each component is identified and after that the waste is weighed for analysis.
2. Analysis

Analysis of the composition of waste is carried out directly at the landfill site by involving the Banjarmasin City waste management officer, a team from the Faculty of Engineering, Lambung Mangkurat University, EKONID, and scavengers who are on site. While the analysis of leachate sample characteristics was carried out at UPTD Banjarmasin City Environmental Laboratory. Quality standards used for leachate characteristics refer to the Minister of Environment and Forestry Regulation of the Republic of Indonesia No. P.59/ Menlhk/ Setjen/ Kum.I/ 7/ 2016, concerning Standards of Leachate Quality for Businesses and/or Activities of Final Waste Processing Sites.

D. Result of Analysis

1. General Conditions of Basirih Landfill

The existence of waste cannot be separated from the existence of human activities from various sectors. Waste must be managed as well as possible especially in urban areas so that it does not endanger other problems. Waste that is not managed will cause a buildup of waste that can cause a foul odor that can interfere with health. Waste can also cause drainage channels to be disrupted due to clogging by accumulated rubbish, which can cause flooding.

Waste piles can produce leachate which can pollute the environment. Leachate is rich in organic matter content and has a high heavy metal so it is dangerous if it is immediately discharged into the environment without being processed first (Ali, 2011). Of the various problems, the waste problem must have special attention and commitment from various parties to manage waste from the source to the landfill.

The results of identification of the composition of waste measurement results in the city of Banjarmasin can be seen in Figure 1 and Figure 2.
Based on Figure 1, it can be seen that the three biggest components that can be recycled are organic waste, plastic, and paper. Organic waste which is the biggest waste can decompose faster and cause odor, and will produce methane gas and carbon dioxide. Efforts to deal with organic waste can be done with easy technology such as composting. Therefore, composting technology facilities and infrastructure must be provided and done properly. Meanwhile, some plastic and paper waste can still be used by recycling. If the three components of waste can be handled by composting and recycling, it can reduce about 80% of the landfill land load. Meanwhile for diaper/sanitary
napkins trash which is the second largest waste, there is currently no alternative technology to be able to process the waste.

The government must set standards for waste management that are appropriate and acceptable to the community. Waste management is not only for collecting, transporting, and disposing, but also for processing and recycling so that waste can be used as a more useful product. Currently, most waste management only moves waste from the city center to the landfill. Whereas the landfill must be a final processing site, not a final disposal site. As a comparison, we can see the composition of waste entering landfills in other countries such as Germany (Figure 3.a) and China (Figure 3.b).

Based on Figure 3, we can conclude that the composition of waste in Germany by 33% is organic waste, but in China is greater at 78%. This shows that the Chinese people produce very little inorganic waste in their lives. In other components such as plastic, Germany produces plastic waste of 14%, while China only amounts to 6%. This shows that in China, plastics are less used than in Germany. Meanwhile, paper waste in Germany is also greater than China at 13%, while in China it is only 2%. This shows the difference in living habits in Germany and in other European countries that paper is more widely used in these countries, especially for shopping in minimarkets or markets. Unlike in China, the
country uses more organic material than inorganic in daily life. This is no
different from other Asian countries such as Indonesia. However, the
difference with Indonesia is that the German Government or the China
Government have effective solutions in waste management with the
technology they have developed.

Comparison of waste composition in Banjarmasin, Germany and
China can be seen in Table 1.

**Table 1.** Comparison of Banjarmasin City Waste Composition with other Countries

<table>
<thead>
<tr>
<th>Waste Composition</th>
<th>Kota Banjarmasin</th>
<th>Jerman</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organics</td>
<td>68%</td>
<td>34%</td>
<td>78%</td>
</tr>
<tr>
<td>Plastics</td>
<td>13%</td>
<td>14%</td>
<td>6%</td>
</tr>
<tr>
<td>Textile</td>
<td>3%</td>
<td>4%</td>
<td>1%</td>
</tr>
<tr>
<td>Paper</td>
<td>5%</td>
<td>13%</td>
<td>2%</td>
</tr>
<tr>
<td>Metals</td>
<td>0%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>Glasses</td>
<td>1%</td>
<td>6%</td>
<td>1%</td>
</tr>
<tr>
<td>Others</td>
<td>10%</td>
<td>27%</td>
<td>12%</td>
</tr>
</tbody>
</table>

Based on Table 1, we can be concluded that the composition of
organic waste in the Basirih Landfill in Banjarmasin is between Germany
and China at 68%. It also shows that half the waste composition in the
Basirih Landfill is organic waste. The large amount of organic waste in
the Basirih Landfill is caused by composting which is considered to be
less than optimal, even though the Banjarmasin City Government actually
has sought organic waste treatment in several place such as TPS 3R and
Compost Houses but has not significantly reduced organic waste. If we
can process organic waste into compost or other material that can be of
maximum value, the Banjarmasin City Government does not need to
expand landfill land. If we compare, the composition of plastic waste in
the Basirih Landfill is above China and almost the same as Germany,
which is 13%. This is a big problem because until now plastic waste has
not been maximally managed by the Government and the private sector.
Whereas in some studies, plastic waste can be used asphalt, paving
blocks, and others. This is an opportunity for the Banjarmasin City
Government or industries in Banjarmasin City to take this opportunity.
Based on Table 1, we can also summarize the factors that influence the urban waste management system, including:

a. Population density and distribution;
b. Physical, social and economic conditions;
c. Waste characteristics;
d. Daily habits and behavior of the people;
e. Distance from the source of waste to landfill;
f. Means of collection, transportation, processing and landfill;
g. Citizen's awareness; and
h. Local regulations.

Several efforts that can be done to reduce accumulation of waste:

a. Prevention and reduction methods (reuse, repair of damaged products, product design);
b. Disposal methods (unused land, ex-mining land, or existing deep holes);
c. Recycling (paper, bottles, plastic, electronics);
d. Composting;
e. Energy recovery (activated carbon, biogas);
f. Waste sorting (organic material for compost);
g. Sanitary landfill;
h. The role of the community and the private sector; and
i. Regulation.

2. Liquid Waste (Leachate)

One of the problems in landfill management is liquid waste from garbage or commonly referred to as leachate. Leachate is a liquid that seeps from a pile of garbage due to the entry of external water into the pile of garbage. The liquid carries suspended dissolved material, especially the result of the process of decomposition of waste material (Musdalifa, 2017).

Leachate must be handled optimally and it must be ensured that there is no leakage of pipelines and not mixed with rainwater channels,
that is because leachate can endanger the environment. One of the
dangers of leachate if it pollutes water is that it can deplete the oxygen
content in water due to biological degradation. The depleted oxygen
content will cause death in living things that are in the water (Ali, 2011).
Therefore leachate should not be directly discharged into the river before
processing. Leachate discharge must also be measured and the
sampling point must be easily accessible for periodic testing.

The results of the analysis of laboratory samples for leachate
samples at the Basirih Landfill such as pH are still within the range of
quality standards. However, for the parameters of Total Suspended Solid
(TSS), COD, and Cadmium (Cd) still have content above the quality
standard. This shows that leachate conditions are not suitable for life in
water and if discharged into rivers will kill aquatic organisms. The results
of the analysis of leachate characteristics in the Basirih Landfill can be
seen in Table 2.

Table 2. Results of Analysis of Leachate Characteristics at Basirih Landfill
Banjarmasin City

<table>
<thead>
<tr>
<th>No</th>
<th>Parameters</th>
<th>Unit</th>
<th>Value of Analysis</th>
<th>Maximum Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Locations 1</td>
<td>Locations 2</td>
</tr>
<tr>
<td></td>
<td>Physics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>TSS</td>
<td>mg/L</td>
<td>444</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Chemical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>pH</td>
<td>-</td>
<td>7,37</td>
<td>7,97</td>
</tr>
<tr>
<td>2</td>
<td>BOD₅</td>
<td>mg/L</td>
<td>287.94</td>
<td>83.58</td>
</tr>
<tr>
<td>3</td>
<td>COD</td>
<td>mg/L</td>
<td>1440</td>
<td>370</td>
</tr>
<tr>
<td>4</td>
<td>Cd</td>
<td>mg/L</td>
<td>0.448</td>
<td>0.056</td>
</tr>
</tbody>
</table>

Based on Table 1, we can conclude that the leachate at location
1 which is an Inlet does not meet the quality standards so it is necessary
to process it first. Meanwhile, leachate at locations 2 and 4 which are
monitoring wells and the surrounding environment looks relatively safe.
It's just that the COD parameter at location 2 is still above the quality
standard. But for leachate located at location 3 which is a processing
outlet, it can be seen that the TSS, COD, and Cd parameters are still high
above the quality standard. That means the processing system is not
working as expected. So if the leachate is discharged into the river it will
be a serious problem for aquatic organisms and the people who use the river.
Another problem for aquatic organisms and people living around rivers is the danger of heavy metal compounds which in this study are Cd or Cadmium. Cadmium is one of the non-essential anthropogenic metals so that at low concentrations it can be carcinogenic, teratogenic, and mutagenic (Pál dkk., 2006; Rumahlatu dkk., 2014; Anshar, 2018). Cadmium is a toxic heavy metal that causes chronic poisoning in humans (Prabowo dkk., 2016). When cadmium metal enters the body, it binds to the metallothionein protein which can trigger an increase in free radicals in the liver and kidneys, so that it can cause damage to both organs (Faroon dkk., 2012; Hernayanti dkk., 2019).

Basirih Landfill already has a leachate management system. But still in a simple form in the collection of leachate that is flowing from one pond to another pond. The pond in the Basirih Landfill is channeled from the first pond to the last one. In the last pond, it is expected that the heavy metal content, BOD5, COD, and TSS will decrease and be below the quality standard so that it can be discharged into the river. However, the results obtained cannot meet these expectations because it turns out that the COD, TSS, and Cd content in outlet location are still above the quality standard. In this study, our team tried to identify leachate components from 4 sample locations such as Inlet, Outlet, Monitoring Well, and Surrounding Environment. We try to present COD, BOD5, and TSS parameter data from 4 sampling locations which can be seen in Figure 4.

![Figure 4. COD, BOD5, and TSS parameters in Sampling Locations](image)

Based on the data in Figure 4, the parameters of COD, BOD5, and TSS have decreased from Inlet to Outlet location, while for Monitoring
Well and Surrounding Environment also decreased compared to leachate at Inlet and Outlet locations. Leachate treatment efficiency was calculated from Inlet to Outlet on COD parameters of 74%, BOD\textsubscript{5} of 67%, and TSS of 47%. Even though it has been processed, the expected results have not been below the quality standard. This shows that leachate treatment in the Basirih Landfill is not optimal.

The wastewater treatment system is designed to set aside BOD, COD and TSS. BOD (Biochemical Oxygen Demand) or biochemical oxygen demand shows the amount of dissolved oxygen needed by aquatic microorganisms to oxidize or break down organic matter in wastewater (Rahmawati, dkk., 2013). Whereas COD (Chemical Oxygen Demand) or chemical oxygen demand is the amount of oxygen needed to decompose all organic material chemically (Lumaela dkk., 2013). TSS (Total Suspended Solid) or total suspended solids are solids suspended in water in the form of organic and inorganic materials that can be filtered with filter paper with a pore size of 0.45 µm. TSS has an adverse effect, namely reducing the entry of sunlight into water bodies so that it can inhibit the growth of aquatic plants (Indrayani & Rahmah, 2018).

E. Conclusions and Suggestions

1. Conclusions
   a. The biggest composition of Basirih Landfill is organic waste, paper, and diapers/sanitary napkins, while the biggest waste that can be recycled is organic, plastic and paper waste.
   b. The content of heavy metals, such as Cadmium (Cd), and also COD and TSS in outlet location are still above the quality standard.

2. Suggestions
   a. Supporting facilities and infrastructure for waste processing must still be improved, such as heavy equipment, composting buildings, leachate treatment facilities, and support for health facilities.
   b. The seriousness of the government in recycling organic and inorganic waste in order to provide economic benefits.
   c. Leachate treatment is needed so that it does not have a bad impact on the surrounding community.
F. Acknowledgement

In this moment the researcher would like to say thank you to Allah SWT, Faculty of Engineering, Lambung Mangkurat University, EKONID, and Banjarmasin City Government. Thanks also were given to survey teams such as Aban, Dika, Nabil, Amin, and Ien, as well as teams from Basirih Landfill, such as Pak Sirait, Pak Rustam, Sabda, and Scavengers.

G. Reference


