CHANGES IN SOIL CHARACTERISTICS UNDER SARIMUKTI LANDFILL, WEST BANDUNG REGENCY

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Abstract: The volume of landfill leachate in Indonesia is quite high, due to the closure of waste is not done on a daily basis. And if the liner layer is not available or is not working properly, then the leachate will go directly to the bottom soil layer. Characteristics of the soil at the base of the landfill may be subject to change due to seepage of leachate from rubbish on it. This study examines changes in the physical characteristics of the soil under the landfill, which include; plasticity index, grain size analysis and the specific gravity. Sampling was conducted at the landfill Sarimukti, West Bandung regency. Samples were taken to look at the possibility of changes in soil characteristics, by comparing karakteristk ground under the landfill (6 samples) and outside the landfill (2 samples). From the results, it can be concluded that there is no significant difference between the Specific Gravity ground under the landfill and outside the landfill, there is no difference between the grain size distribution of the soil beneath and outside the landfill, while the Plasticity Index land under landfill higher than in outside the landfill, so it has the ability to absorb water and develop higher shrinkage

Keywords: infiltration, landfill, leachate, physical characteristics, soil

PRELIMINARY

Due to the operational costs are low, almost all of Indonesia's waste dumped into landfills, by open dumping. UU no. 18/2008 on waste management make development activities and rehabilitation of landfill became rampant in Indonesia. Within the scope of the design, the geotechnical characteristics become very important in the design and maintenance of landfills. Leuwigajah landslide in landfill case in 2005 that killed 147 people realize that the landfill is an engineering structure that must be considered from the aspect of the stability of the embankment.

This study is a preliminary study, which analyzes the differences in physical characteristics of the soil under the landfill and outside the landfill, at the same location, to see the possibility of change in the characteristics of the soil due to seepage of leachate.

As an initial assessment to determine whether the physical characteristics of the soil changes due to infiltrated by leachate, conducted sampling in zone 1 and zone 2 TPA Sarimukti, West Bandung regency. Samples taken at the heel landfill that has a depth of about 3 meters. TPA Sarimukti overall area is 25 hectares, with a large percentage of landfill by 60% of the total area of the landfill. Hopefully this research can provide initial information for further research to determine the geotechnical behavior of landfill in Indonesia.

LITERATURE REVIEW

Open dumping landfill, without liner, allowing leachate to easily pass through the soil strata. This may have an impact on changes in soil properties. Milad, ZA (2014) conducted an experiment on two types of soil; muddy sand and clayly sand beneath Al-Jahra Landfill, Kuwait. Results from shear and consolidation on solid ground specimens that interact with leachate showed a greater influence on the properties of clayly sand rather than the loamy sand. Zupanc (2010) mentions that the leachate at the landfill significantly increases the available water capacity of up to 52%.

Meryl George and K.S. Beena (2011) presents the results of a study of various geotechnical characteristics (limit of consistency, shear strength and hydraulic conductivity) in soil contaminated leachate. The results show that garbage leachate contamination increases soil permeability and shear. However, consistency limits of soil decreased as a result of leachate contamination.

METHODOLOGY

Sampling was conducted in Sarimukti Landfill, West Bandung regency. Samples were taken to look at possible changes to the basic soil characteristics, by comparing the characteristics of the soil under and outside the landfill. The sampling is done under zone 1 and zone 2 TPA Sarimukti. From each sampling point, 3 samples were taken to test the characteristics of the soil in the laboratory, at different depths, sample depth specified on; (a) 0 - 1m, (b) 1-2 m and (c) 2-3 m beneath a layer of trash, in zone 1 and zone 2 TPA Sarimukti. For comparison, the native land inside Sarimukti landfill area that is outside the zone of landfills were also taken. Figure 1 shows the depth of soil sampling (disturbed) for laboratory tests.

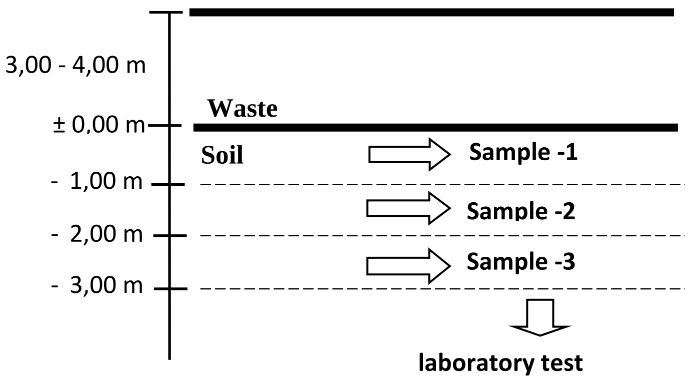

Fig 1. Soil sampling under landfill.

Physical properties testing conducted is the water content (ω), specific gravity (Gs), sieve analysis, hydrometer analysis, liquid limit and plastic limit.

RESULTS AND DISCUSSION

Sampling

Sampling was conducted on March 22, 2015, when the current in sunny conditions, sampling is done at three points, including; one point below the zone-1, one point below the zone-2 and one other point in the area that is not under the landfill site. Table 1 and Figure 2 shows the location of the sampling

Table 1. Sampling Location

Location	Coordinate	Sampel Depth 1)
Zona 1 TPA Sarimukti	6°47'53.75" S 107°20'58.17" T	± 0 - 1 meter
		± 1 - 2 meter
		± 2 - 3 meter
Zona 2 TPA Sarimukti	6°47'56.50" S 107°20'57.74" T	± 0 - 1 meter
		± 1 - 2 meter
		± 2 - 3 meter
Area bukit	6°47'51.43" S 107°20'54.59"T	± 0 - 2 meter
		± 2 - 4 meter

Note: 1) of the boundary between the waste layer and soil layer

Fig 2. Sampling (disturbed); (a) subgrade soil under zone 1, (b) soil outside the zone of landfills.

For the purposes of laboratory analysis, of any depth, take as much as ± 50 kg of soil samples (in disturbed conditions). The sample is introduced into a sample bag, and then inserted into the sample box, and sent to the laboratory of Soil Mechanics. Samples taken are disturbed samples that require treatment prior to laboratory testing. Soil samples were dried at room temperature, after dried, crushed soil samples with a wooden bat slowly to separate the grains of soil. Soil samples through sieve No. 04. taken for further testing

Specific Gravity Test Results

Table 2 shows the test results of soil sample specific gravity, of the six samples under landfills, and the two samples were not under landfills. The sixth sample was assumed as a random sampling under the landfill area. Of the six samples that were under the landfill area, obtained a mean of Specific Gavity (Gs) by 2.56, with a standard deviation of 0.021. Meanwhile, from the two samples taken from an area that is not under landfills, gained an average of Gs of 2.55. To prove whether the Gs value of soil that is under landfills, equal with Gs of soil that is not under the landfill, then the t test (one sample), with H0: mean Gs ground under the landfill = 2.55, and Ha: Gs mean ground under the landfill ≠ 2.55. T hitung obtained by 1.11, and with a confidence level of 95%, and the number of samples (n) as 6 pieces, obtained t table value of 2.571. Due t hitung smaller than t tabel, then H0 is accepted, which means there is no significant difference between Gs of soil under the landfill with a value of 2.55 (Gs of soil in the area outside the landfiill).

Table 2. Specific Gravity Test Results

Kode Sampel	Spesific Gravity
Under Zona-1	
S1.1.1	2,58
S1.1.2	2,58
S1.1.3	2,56
Under Zona-2	
S1.2.1	2,53
S1.2.2	2,55
S1.2.3	2,54
Average (under landfill)	**2,56**
Outside landfill	
S1.3.1	2,55
S1.3.2	2,55
Average (outside landfill)	**2,55**

Particle Size Distribution

The sample is spread and dried to air dry conditions. Wooden hammer used to break up clots without destroying the grain samples that had been air dried. Samples were filtered separately with a filter 4 (him. 4.67), and a 200 gram sample through sieve no. 4 is used for the analysis of grain size distribution. The smallest is 200 sieve sieve with a diameter of 0.075 cm. Granules through sieve no. 200 tested further in hydrometer analysis. Figure 3 shows the grain size distribution of the eight samples

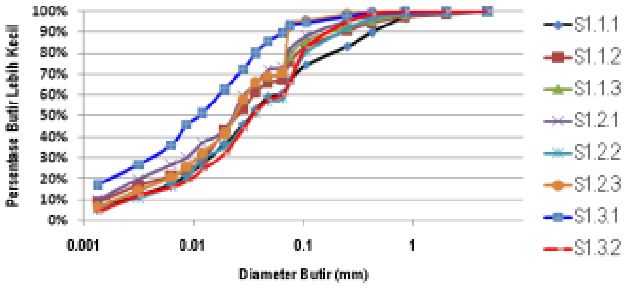

Fig 3. Grain size distribution of soil samples

Atterberg Limits Test Results

Atterberg divide the land into four basic condition, solid, semi-solid, and liquid plastic, which form the boundary change from one condition to another condition known as Atterberg limits. Soil samples were taken to test Atterberg limits of samples sieve no. 30. Table 3 shows the test results of Atterberg limits.

Table 3 Test Results of Atterberg Limits

Sample Code	Liquid Limit (LL)	Plastis Limit (PL)	Plasticity Index (IP)
S1.1.1	74,91%	35,98%	38,92%
S1.1.2	78,98%	39,35%	39,63%
S1.1.3	78,02%	40,48%	37,54%
S1.2.1	75,22%	36,01%	39,21%
S1.2.2	68,55%	33,98%	34,57%
S1.2.3	73,19%	36,12%	37,07%
S1.3.1	70,98%	39,05%	31,93%
S1.3.2	84,12%	36,67%	47,45%

Of the six samples under the landfill area, obtained a mean plasticity index (IP) amounted to 37.82%, with a standard deviation of 1.714%. Meanwhile, from the two samples taken from an area outside the landfill, only taken on samples S1.3.1 IP value as a comparison (by 31.93%), this is because the value of R2 in the test results (liquid limit) S.1.3.2 quite small (R2 = 0.414). To prove whether the IP of soil under the landfill equal with IP value outside landfill, the t test (one sample) is done, with H0: IP of soil under the landfill = 31.93%, and Ha: IP of soil under landfill ≠ 31.93%. Tcount obtained at 8,42, and with a confidence level of 95%, and the number of samples (n) as 6 pieces, obtained t table value of 2.571. Due tcount greater than t table, then H0 is accepted, which means there are significant differences between the IP of soil below the landfill with a value of 31.93% (IP of soil outside the landfiill area).

CONCLUSION

From these results, it can be concluded that:

- ✓ There are no significant differences between the Specific Gravity (Gs) of soil under the landfill with a value of 2.55 (Gs of soil outside of the landfill).
- ✓ There is no difference between grain size distribution of the soil under and outside the landfill area.
- ✓ Plasticity Index of soil under landfill higher than the outside of the landfill area, so it has the ability to absorb water and shrinkage level of the soil is increased.

In general, it can be concluded that there is no difference between granular soil under and outside the landfill. However, an increase in the value of plasticity index, which should be a concern. Soil with high plasticity, making shrinkage of the soil becomes high, and movement due to shrinkage of this land can damage structures contained in it, such as layers of liner and leachate collection system.

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