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Enhance Utilization of Bentonite, Lime and Waste Buildings to Increase the Land Capacity Tropical

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Abstract— *Tropical soils are generally dominated by clay minerals which have a capacity Cation exchange (CEC) and low electric charges resulting in sortition capacity low to soil electrolytes (especially ground water). Flow ability the electron charge that comes from a lightning strike becomes low and resistant soil type becomes high. This has an impact on the ability to flow through the load electrons from lightning strikes become low. For this reason treatment is needed of land that will be used as a grounding media in a way addition of additives. This study uses grounding media between soil mixtures (T) with debris (P), soil with bentonite (B), and soil with lime (K). Each mixture (T: P), (T: B), (T: K), made with a concentration of 25:75, 50:50, 75:25 and 100% land as a control. Distance between electrode implements between 1 meter treatment group, and different ground dimensions. The measurement method used is a three-point method with using a single ground rod electrode. The results showed the best response to decline successive resistance is in the soil mixture with debris, then followed by soil with lime and soil with bentonite. Water content effect on decreasing soil resistance. The greater the water content*.

Keywords— *Water content, grounding media, resistance.*

I. INTRODUCTION

Tropical land is classified as very wide distribution in the world, and in Indonesia. Generally tropical soils are dominated by clay minerals which have an exchange capacity Low cation (CEC) and low electric charge resulting in capacity very low sortation of soil electrolytes (especially ground water) moreover when dry. This means the ability to flow from the originating electron charge from lightning strikes to low too, which often lead to disaster, i.e. damage to electrolyte equipment due to induction generated by lightning strike (Induction, 2004).

The danger of lightning induction is greater in densely populated settlements like urban areas that are generally impermeable to surface water infiltration. In such areas, grounding electrodes are generally frequent not effective in delivering electrons from lightning strikes because of enlargement of soil type resistance due to particularly low soil water content in the transition from the dry season to the rainy season where the frequency of lightning increased sharply while groundwater conditions were still very low. This is right with the results of research Kristantri and Kurniawati (2016), stated that the highest number of lightning strikes occurs in the transitional season, Tropical land is classified as very wide distribution in the world, and in Indonesia (Eddy, Alamsyah, Aryza, & Siahaan, 2018).

Generally tropical soils are dominated by clay minerals which have an exchange capacity Low cation (CEC) and low electric charge resulting in capacity very low sorption of soil electrolytes (especially ground water) moreover when dry. This means the ability to flow from the originating electron charge from lightning strikes to low too, which often lead to disaster, i.e. damage to electrolyte equipment due to induction generated by lightning strike (Bachtiar, 2006).

Anticipating lightning events is to make protection from lightning hazards, by flowing lightning currents to the earth (grounding) with the aim protect living creatures and buildings to avoid fatal damage. For this reason, a good grounding system is needed. According to General Conditions Electrical Installation or PUIL 2000 (appropriate regulations and valid until now this) the total earth resistance of the entire system must not exceed 5 ohms. It was explained that a value of 5 ohms was the maximum value or limit highest yields of grounding resistance that can still be tolerated. Values that are in the range of 0 ohms - 5 ohms are safe values of an installation earthing grounding. This value applies to the entire system and installation which has a ground (grounding) in it. For resistance areas soil type is very high, resistant to total earthing of the entire system reach 10 ohms. Addition of bentonite will result in better earthing resistance (Rabanal-Arabach, Schneider, & Cabrera, 2015).

The research results of Lim, et al., (2013), prove that 30% bentonite concrete mix consistently produces the lowest grounding resistance value. Sunarto (2013), states that the addition of bentonite additives around the electrodes Earthing greatly influences the value of earthing resistance. Where with Addition of bentonite additives will produce an earth resistance value better. The decrease in the value of earthing resistance ranges between 6.96 ohms to 5.85 ohms or reduced between 15% - 90%. This behavior leads to the imagination that the magnitude of the specific electrical charge of the material Grounding is greatly affected by its ability to hold water. Pg this means the ability of the grounding material greatly affects the inside electricity or reduce the resistance of the type(Suryaputra P., Samopa, & Hindayanto, 2014).

II. LITERATURE REVIEW

The location of Indonesia, which is crossed by the equator, makes Indonesia climate tropical. So that Indonesia is known as a country with a lot of rain, a lot of growth Comulonimbus (Cb) clouds and lots of lightning and thunderstorms. As one of the an area that has an average Thunder Storm Days intensity pervery high year, this allows a lot of harm to happen caused by lightning strikes, which allows a lot to happen damage

caused to property and death of living things around because of a lightning strike.

Today's modern society erects many tall buildings, be it for settlements or tower buildings for telecommunications networks, so lightning is a very serious obstacle because of its ability to damage. The emergence of damage due to lightning strikes, then emerged a variety of businesses to overcome the danger caused by lightning strikes. Protection system that is must be done aiming to protect the building from direct strikes or indirect strokes. So with the concept of protection above the lightning protection system is generally divided into 2 namely (Ugahari, 2007).

This system serves to protect the building and its contents from a direct strike of lightning which is to divert then capture the lightning strike to a safer area and channel current lightning to the ground.

Internal Protection System

This system serves to protect the building from no strikes direct lightning is the induction of the magnetic field caused by the lightning current which will be landed.

One of the initial efforts to minimize losses due to lightning is installation of safety systems in these buildings. System that security is one of those external grounding systems / lightning rods that is reliable and meets the requirements that apply because of a safeguard building or object against lightning strikes is essentially a provision.

A system that is well planned and implemented, so that if a strike occurs then this means that will channel the lightning current into land safely without causing danger to humans or objects other dangerous inside, outside or around buildings.

Land is a natural object made up of solids (minerals and materials organic), liquids and gases, which occupy the surface of land and space. Most soils in Indonesia are acidic due to high rainfall so the salt washing process is intensive. Soil in the tropics has a fairly high variation in both physical properties as well as their chemical nature. These variations are an inseparable part of variations in temperature and rainfall in the tropics. It can even be mentioned that the diversity of soils in tropical regions is proportional to the diversity of climatic conditions, both local and regional. The diversity of chemical and physical properties of the soil in the region the tropics can be expressed as a distribution of fertility and productivity.

Oxisol is a soil that is rich in iron and aluminum oxide. This land is a lot scattered in the wet tropics and has the following characteristics, namely solum shallow, less than 1 meter, rich in sesquuioxide that has been experienced weathering further, the presence of an oxic horizon at depths of less than 1.5 m, the horizon A, B, and C with a specific B horizon are red yellow to brownish yellow and the most fine-textured clay, containing Fe / Mn concretion of quartz layer (Arief, 2013). This class of land is classified by the formative element is ult, short for ultimus (last). Represents a land that is have experienced the most severe weathering, marked by influence washing. Ultisols soils thrive in tropical hot climates. Have horizon argila (white clay) which has a clay with more alkaline saturation lower than 35%. The surface horizons are red to yellow, indicates the presence of free iron oxide accumulation. Ultisols are formed in the old land surface region, generally under forest vegetation, (Sumarno, 2014).

Oxisol soil has a high clay content but is not active so cation exchange capacity (CEC) is low. The value of the CEC for the land Oxisol is less than 16 me / 100g clay. This oxisol soil is dominated by minerals with low activity, such as quartz, kaolin, low nutrients, contain high iron oxides and Al oxides. Whereas the land Ultisol is an acid soil with a deep layer, formed in forests and consists of clay. The characteristics of this soil are organic matter content, saturation of bases and low pH (pH 4.2-4.8), the process of podsolization occurs: process washing of organic material and sesuiui where the accumulation of Fe and Al and Si washed, the parent material often has yellow, red and gray spots so deeply composed of silica, ply, sandstone and clay, formed in climatic regions such as Latosol, differences due to parent material: Latosols are mainly derived from alkaline and intermediate volcanic rocks, while soil Ultisol comes from igneous rock and tuff. The most widespread land Prospect of Building Debris as a Detention-Reducing Material Type.

Population growth and the need for shelter make people to continue to build. Not only new buildings but also many repair / restore old buildings that are felt to be wider. The impact of the restored building and renovation was a piece of debris building.

Figure 1. Samples of Soil This Research.

In Indonesia, debris is usually not treated, but just thrown away so that it will be piled neglected, piled up in parts of the land open or used as a backfill material. It is estimated that 15% to 30% of solid waste disposed of in landfills is construction waste (Bossink and Brouwer, 1996). For this reason, it is necessary to find a solution for the utilization of building waste. Utilization of building debris can reduce buildup problems debris and can also help protect the environment from damage caused by buildup by building debris, as well as material savings and reduction of waste (waste material).

Waste is a substance or waste produced from a process production, both industrial and domestic (households), whose presence is once particular time the environment does not want because it can degrade environmental quality. From this understanding it can be concluded that waste is a substance or object that is polluting the environment. Waste has no economic value, therefore waste is disposed of. Balance the environment becomes disturbed if the amount of waste is exceeded threshold. With a certain concentration and quantity,

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the presence of waste can have a negative impact on the environment. Waste from building debris many will become problems and interfere with aesthetics. For that, it must be sought solution for its utilization.

III. METHOD OF RESEARCH

Calculation of ground water content is done every 3 days for 15 days experiment, by taking samples in each unit of the experiment and put in a labeled aluminum cup. Weigh the weight sample, then mengoven the sample until the sample dry weight is constant. After constant sample weights were repeated. Difference in weight before di the oven and after curing is the amount of water contained in the media. Then do the calculation of the value of the water content.

This papers uses a single grounding rod (single grounding rod) with the 3 point measurement method (tree point method). Observation parameters is the grounding material and the concentration of the mixture between the ingredients. Mixture of ingredients used are soil (T) with debris (P), soil with bentonite (B), soil with lime (K). Each mixture (T: P), (T: B), (T: K), is made with concentrations of 25:75, 50:50, 75:25, and 100% land as a control. Distance planting electrodes between treatment groups is 1 meter. Parameters are to be measured is land resistance. From the land prisoners will get a type of prisoner soil and earth resistance value using the HB formula. Dwight.

In addition, the calculation of water content values is also done by taking media sample and dry it. Calculating water content is done by taking media samples grounding and inserting the sample into the aluminum cup that has been provided. Weigh the sample weight, then dry the sample with the way in the oven until the sample weight is constant. Weigh the dried sample.

The difference between the weight before the oven and after the oven is done the amount of water contained in the sample. Do the same thing to whole sample.

Measurement data will be analyzed by making a comparison chart between water content and soil type resistivity. Furthermore the data analysis results will be seen to find out whether the water content in the grounding medium influences against reducing soil resistivity.

IV. ANALYZE AND RESULT

The formula used to calculate water content is: Moisture content (%) = initial sample weight - final sample weight / Final sample weight x 100%

The data in the research are data obtained from the results of data collection in the form direct measurement both in the field and in laboratory. Before carrying out the data it is necessary to test the characteristics of the properties electricity of bentonite, so that from the test can be analyzed:

1. Effect of laying bentonite around the rod electrode (rod).
2. Effect of uniform bentonite volume with several model of variation of the laying of bentonite against the value of resistance earthing. Here are the results of measurements directly with using the Earth resistance tester:

Table 1. Value of Resistance Ground

Testing	Conditions	Re (ohm)
Stick Conductor	Normal	9,34
Vertical	Position 1	7,41
	Positions 2	7,08
Stick conductor	Normal	4,42
Horizontal	Positions 3	4,01
	Positions 4	3,32
	Positions 5	3,23

Figure 2. Take Sample for Measurement of ground resistance on the media.

Figures 3. Samples of the media to be dried are put in a cup aluminum.

Measurement of bentonite resistivity by using the measurement circuit, the calculation can be obtained as follows:

Data for measuring bentonite resistivity (position 1 and position 2):
R (bentonite resistance) = 80.4 ohms
l (test tube height) = 5 cm
r (radius of the test tube) = 2 cm
So the resistivity of bentonite for testing position 1 and position 2 is worth 201.96 ohms-cm
Data for measurement of resistivity (positions 3, 4 and 5):
R3 (position resistance 3) = 0.31k ohms
R4 (position resistance 4) = 0.23k ohms
R5 (position resistance 5) = 0.18k ohms
l (test tube height) = 5 cm
r (radius of the test tube) = 2 cm

V. CONCLUSIONS

From the described of this study it can be concluded:

1. The best response to successive decreases in resistance is on soil mixture with debris, then followed by soil with lime and soil with bentonite Additives of 25% decreased the resistance

value by 23.4% for debris, 15.1% for bentonite, for lime there is no decrease. Additive by 50% decreases the resistance value by 42.6% for debris, 34.8% for lime. Addition of additives by 75% decreases value resistance of 46.3% for debris, 42.56% for lime. While for bentonite at an additional 50% and 75% there was no decrease due to a crack.

2. Water content affects the value of resistance. The higher the water content then the resistance value gets smaller. This applies both to blends soil with debris, soil with bentonite and soil with lime.

3. The size (dimensions) of the grounding media affect the resistance value. The larger the media size the smaller the resistance value.

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