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COCONUT FIBER USAGE FOR THE COMPRESSIVE STRENGTH BRICK MATERIALS

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ABSTRACT*: This study was conducted to calculate the strength of brick materials that already mixed with fibers of coconut. Using coconut fiber mixture was aimed at producing a better composition of concrete. An experimental design was applied to the composition of cement, sand, water and coconut fiber with a ratio of 1 PC cement. It made the ratio was 4.5 PS sand. The strength testing or compressive strength after the materials have been dried as long as 28 days. The averaged at variation I (0%) of 1 kN / cm2, variation II (1.5%) of 0.498 kN / cm2, variation III (1.8%) of 0.441 kN / cm2 and variation IV (2.1%) of 0.379 kN / cm2 were done. It concluded the addition of coconut fiber with brick materials produced has a decreasing compressive strength value.*

KEYWORDS: coconut fiber, materials of brick, compressive strength, test

INTRODUCTION

Coconut trees are widely spread in almost all parts of Indonesia, especially in Southeast Sulawesi, both in areas that are often rainy and dry areas such as on the coast. Coconut fiber fibers have the advantage of being resistant to microorganisms, weathering and mechanical work (rubbing and punching) and lighter than other fibers. Coconut fiber fibers also have resilient properties, can absorb water, and have a good level of durability if it is not directly related to the weather (Mulyono, 2004). Therefore, coconut fiber fibers were selected in this study given the availability of quite a lot so that the price is cheap. Concrete is a composite material (mixture) of several materials, the main material consisting of cement, fine aggregate, coarse aggregate, water and other additives with a certain ratio. The mixture of concrete forming materials is set in such a way as to produce fresh concrete that is easy to work with and meets the compressive strength of the plan after it hardens and is quite economical.

Therefore, concrete is widely used and used in construction. A brick of light weight concrete has a density which falls into lighter than concrete in general. This small light weight concrete density reduces the weight of the structural elements itself resulting in the need for cross-sectional dimensions become smaller. In addition, with a lighter weight structure, for areas that have a large earthquake risk, especially in Indonesia, the earthquake force acting on the building will be smaller. Lightweight concrete can be produced using lightweight aggregates, which can

be obtained naturally for example coco fiber. Light weight concrete can also be produced by entering air into a mortar, so that air pore occurs in the measuring 0.1mm – 1mm. Or light weight concrete can also be produced without using fine the aggregate of sand in the paste mixture or often referred to as non-sand concrete.

Light weight concrete mold made from a mixture of cement sand and water with a certain ratio used for wall mounting. Bricks have several advantages compared to brick use, these benefits can be seen in several aspects, for example in terms of working walls faster than red bricks, and if the brick quality is the wall does not need to be plastered. The more advanced in the world of development, the more innovations began to emerge in the manufacture of concrete blocks to add quality and quality of concrete blocks. By adding added ingredients, it will increase the strength of the brick or brick compressive strength.

The addition of other materials, especially natural fibers in normal concrete certainly has its own method of analysis. Addition of fiber in a certain proportion is likely to affect the overall behavior of concrete structures. The effect of these changes needs to be investigated to provide precise information about the behavior and capacity of fibrous concrete, especially coconut fiber.

RESEARCH METHOD

This research was conducted using Trials at the Concrete Laboratory of the Faculty of Engineering, University of North Sumatra, Indonesia. The object of research is coco fiber as a mixture of brick material with a mixture of variations, 0%, 1.5%, 1.8% and 2.1% of the compressive strength test and is carried out after the concrete is 28 days old. The percentage variation in this study is the addition of coconut fiber and reduction of sand. It took 20 pieces of test specimens with each variation per mixture of 5 (five) pieces. Making test specimens made with cylindrical molds.

In general the sequence of stages includes:

a. Preparation of material for the preparation of test specimens

b. Examination of the constituent material of the test specimen

c. Planning mix of test specimens with brick material (mix design)

d. Manufacture of test specimens

e. Slump test testing

f. Printing of test specimens with cylinders

g. Dismantling the mold which is left for 24 hours

h. Test specimen for 7 days

i. Lifting the test specimen from the tub

j. Making capping of test specimens

k. Testing of concrete compressive strength is 28 days old.

Filter analysis is an activity to determine the distribution of thirst and coarse aggregate sizes using certain standard filter sizes indicated with a filter hole (mm) and for the value of whether the aggregate is suitable for concrete production. One of the basic compositions of a concrete mixture is a fine aggregate and fine aggregate, so the aggregate test must be carried out so that it gets the appropriate aggregate. The appropriate aggregate is the aggregate under SSD conditions, after aggregate under SSD conditions, the aggregate needs to be analyzed. In this case the filter analysis is intended to determine the MHB in the aggregate. MHB is an index used to measure the fineness and hardness of an aggregate item. This is intended to determine the large and small diameter of an aggregate that is used to find a comparison of the aggregate mixture because the size of the aggregate also affects the stability of the concrete.

If the aggregate grains have the same size, the pore volume will be large. Conversely, if the size of the grains varies, a small pore volume will occur. This is because the small grains will fill the pores between the larger ones, so the pores become small, in other words the high density. Aggregates with poor gradations cannot be used as concrete admixtures, therefore gradations of fine aggregates greatly affect the strength of the concrete mix.

Following this a fine aggregate sieve arrangement can be seen in table 01.

Table 1: Composite Aggregate Sieve Arrangement

Sieve Arrangement (mm)	Level of test-Passing (%)
9,5	100
4,75	95 – 100
2,36	87 – 100

1,18	74 – 85
0,6	46 – 60
0,3	15 – 30
0,15	02 – 10

Source: ASTM C33 Source

In the aggregate for the manufacture of mortar or concrete is desirable a grain that has high compactness, because the volume is small and this means it only requires binding material. The degree of fineness or hardness of an aggregate is determined by the fineness modulus or finesse modulus.

Fine sand 2.20 <FM ≤ 2.60

Medium sand 2.60 <FM ≤ 2.90

Coarse sand 2.90 <FM ≤ 3.20

FM values can be found using the formula: $FM = \frac{\sum \% \, Tertahan \, Kumulatif}{100}$

RESULTS

From the experimental results obtained Fineness Modulus (FM) of 2.77%, it can be concluded that the sand that is used includes medium sand because it is in the standard medium sand, namely FM between 2.6 and 2.9. Content weight is the ratio of the weight of the aggregate to the content test the weight of the content in the aggregate is useful for converting from units of weight to units of volume. In designing concrete mixes the composition of materials is determined in units of weight. When making concrete in the field with a less practical weight composition, it is usually in the field using a comparative composition, which is the volume. To convert from the composition of the unit of volume, and weight is used.

The weight of the contents in a loose and curved way must meet the requirements; the weight of the contents is more than 1125 kg / m3 for the loose way and the weight is more than 1250 kg / m3 for the way of cornering. From the results obtained in the table above, the material meets the requirements. Specific gravity needs to be known to determine the amount of aggregate; there

are 3 states of sand used in this experiment, among others: dry sand where the pores of sand contain air without water with a water content equal to 0%. Then in a state of SSD where the surface of the sand is saturated with water vapor while the inside is dry. Sand in this condition is often used and finally in all situations where the sand is totally wet with water saturated sand.

The sand used for the experiment is still wet, even though the surface of the sand has no water. This sand is still wet even though the surface of the sand has no water. The requirements for SSD weight must be between dry density and pseudo density, while for absorbs specifications must be less than 5% of the inspection results obtained, the material meets the requirements. Fine aggregate in its function as a concrete mixture material must be cleaner than mud. The use of cement will be more and more if the aggregate sludge is getting more; this is due to the more surface area that must be covered while the thinning adhesive solution which causes binding will reduce the strength of concrete. The main thing that must be shown in the fine aggregate is its cleanliness. It is estimated that dirty parts such as mud and clay will be reduced. The results of the examination of sludge levels can be seen in the following figure 04.

The percentage of sand sludge obtained was 2.6%. This sand is suitable to be used as a material for making mix designs, because it meets the requirements, which must be less than 5%. In using a proportion of a mixture of brick material or lightweight concrete with coconut fiber, the composition of the mixture is obtained in a weight ratio, which is based on the calculation of the reduction in sand weight. Addition of fiber in a certain proportion is likely to affect the overall structure of concrete behavior. The percentage variation of coconut coir used is 0%, 1.5%, 1.8%, and 2.1%. to find out the compressive strength value is made with a cylindrical test specimen. Coconut coir used is coconut coir that is clean, dry and ready to use. Coconut coir can be obtained by buying at coir craftsmen, mats processing factories, or coconut sellers. The length of coconut coir used is ± 5 cm.

DISCUSSIONS

In accordance with the research planners that the composition of added ingredients using coconut fiber or coco fiber. This composition uses 4 (four) variations in which each variation gets 5 (five) samples with a total of 20 (twenty) samples from all of the variations. After the variations were used in a percentage mix of 0%, 1.5%, 1.8% and 2.1%, those variations were in the use of added ingredients by reducing the weight of the sand. The following list shows the coconut fiber composition.

Table 2 Percentage of composition of coconut fiber

Varieties	Cement (%)	Sand (%)	Cc fiber (%)	Water (%)
I	16,7	75	0	8,3
II	16,7	73,5	1,5	8,3
III	16,7	73,2	1,8	8,3
IV	16,7	72,9	2,1	8,3

Source: Lab Test

Slump value is the value obtained from the slump test results by means of fresh concrete filled into a steel funnel in the form of a cone beheaded, then the vessel is pulled up so that the fresh concrete melts down. The amount of fresh concrete surface subsidence is measured, and is called the "slump" value. The greater the value of the slump, the fresh concrete is thinner and this means that it is easier to work with. Based on the material used is a brick material that uses a little water and does not use coarse aggregate / gravel, the slump value obtained is very low. The concrete slump test is a test that is carried out specifically to measure how thick the concrete mix is. This is important to do in order to find out how easy the concrete is to work or workability. Another objective of this test is to determine the slump value of the planned fresh concrete and to compare the actual slump value with the slump value of the plan.

In other words, this concrete slump test is to control the quality of the concrete by knowing how well it mixes the concrete before it is used. In terms of the word slump means "slump". That way, the slump test carried out on a concrete stir has the aim of knowing how much deterioration has occurred due to the concrete stirring process when tested with a special test tool called the cone of Abrams. This has something to do with the amount of water mixed in the concrete mix. If too much water is used in mixing the concrete it will have an impact on the strength of the concrete that will be produced later.

The graph the difference in the value of the slump is very clear; because the ingredients mixed in the brick using coconut fiber. As we know that coconut fiber is in the form of fiber. The nature of the fiber is a bit stiff, flexible, easy to tangle, strong and easy to absorb water so that the water in the concrete mixture shrinks. This is what can greatly influence the value of slump.

The weight of the test material is very influential on the compressive strength of concrete, the heavier the concrete means the concrete is already solid, the better the compressive strength. The type of concrete used can be known from its weight. If its weight reaches more than 12 kg, it

means that the concrete used is normal concrete, whereas concrete weighing no more than 11 kg, the concrete is lightweight concrete.

From the average results obtained from each variation that the greater the percentage of use of coconut coir mixture, the weight will decrease. This is due to the coconut fiber which is rather rigid which makes the concrete not solid so that it can create cavities in the concrete. Compressive strength testing is testing the final stage of this study to determine the results obtained from planning according to whether or not. After going through the process of testing the weight of the test object the concrete is then tested its compressive strength with each variation of 0%; 1.5%; 1.8% and 2.1%.

Data showed that the compressive strength received by each variation is very much different, so far from the expected results. As we can see in figure 07 the highest compressive strength is obtained by variation I which is 0% by 10.1 MPa, while the lowest compressive strength is obtained by variation IV which is 2.1% by 3.8 MPa. This is because coconut coir as a mixture material that is too much is not able to condense the concrete, on the contrary the volume of the concrete will be reduced due to the concrete cavity created by the presence of coconut coir because it is fiber making it difficult to blend with concrete. Meanwhile, if seen from the physical requirements of concrete bricks in the SNI table the compressive strength still meets the quality requirements, namely at the level II quality. With these results, the requirements for coconut coir as a mixture of concrete brick still meet the concrete compressive strength test requirements.

CONCLUSIONS

From the results of the study and obtained the results of testing that begins with the examination of material that is fine aggregate testing, cement testing, slump test testing and up to concrete compressive strength testing in the concrete engineering laboratory of North Sumatra University. So that the conclusions of the research can be drawn as follows:

a. From the results of the analysis I got about the effect of coconut coir with a mixture of brick material on the compressive strength test the results did not meet the expected results, namely the lower compressive strength.

b. Concrete samples that produce the lowest average concrete compressive strength are concrete samples with variation IV, which is the highest percentage of coconut coir mixture with 2.1% with concrete compressive strength of 3.8 MPa.

c. When viewed from the percentage of use of coconut coir the results obtained from the compressive strength test decreases. Meanwhile, if seen based on physical requirements, coconut coir concrete bricks still meet the requirements, namely the level II quality.

d. The maximum value of the percentage of use of coconut fiber that can meet the requirements is 1.8% in variation III. While the minimum value of percentage of coconut fiber use is 1.5% in variation II.

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