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THE USE OF SUGARCANE BAGASSE ASH AS AN ALTERNATIVE TO CEMENT COMPOSITE IN CONTRAST TO K-175 QUALITY CONCRETE

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Abstract

Concrete is in an ever-increasing needs, making the other composites such as cement and other mixing materials such as coarse aggregate, fine aggregate, water, and other elements increased too. Within the current condition, the materials obtained from nature is decreasing in amount due to exploitation. Various experiments are conducted so as to find alternative natural source to substitute concerete mix composites. There are many sugarcane bagasse scattered around—as Indonesia is one of the biggest sugar producer—and it leads to an experiment to use sugarcane bagasse as a concrete composite. A limbah that was once not valuable now can be beneficial. Concrete mix of sugarcane bagasse ash was added in various proportion. In this case, the bagasse ash is used as an alternative for cement. A variation used in this study is 0%, 8%, 10%, and 12%. The testing object was cylindre 15 cm x 30 cm and compressure strength planningf'c ± = 14,5 MPa (K 175) the concrete's compressure strength is then correlated in 28 age days. From the research conducted, after underwent 7 days treatment, it is obtained that hasil kuat tekan beton of 28 days old with additional 0%, 8%, 12% of sugarcane bagasse ash in order is 18,17 Mpa, 15,04 Mpa, 10,03 Mpa, 8,62 Mpa. The result shows that the kuat tekan experienced some decrease along the increasing addition of sugarcane bagasse ash in the composites. This also indicates that sugarcane bagasse ash can not be used as concrete composites.

Keywords: ***Mixed concretes, bagasse ash, compressure strength***

Introduction

Development is being rapid, requiring concrete to be always in high demand. And it does not seem to stop anytime soon. Concrete is a very popular element because of its flexible nature. Its composites consist of sands, batu pecah, cement, and water; all are very easy to find. It also requires so little care and has kuat tekan yang tinggi (Gemelly, Katrina, 2014).

The higher demands for concrete in the future, the higher demands for cement composites and other mixing materials too, such as coarse aggregate, fine aggregate, water, and others. Unfortunately, the resource from nature has decreased rapidly due to neverending exploitation. Many experiments have been conducted so as to find other alternative natural resource for natural aggregate.

There are arrays of experiments that have been going to improve concrete strength, one of them is alternating the material for shaping the concrete itself. This means attempting to substitute the composites materials, be it coarse aggregate, fine aggregate, cement, or other additionals to increase the daya rekat of the bahan pengikat in the concrete. The material used as an alternative then focused by using material limbah. The limbah used in this study was sugarcane bagasse ash, as a concrete mixture that may amplify the compressure strength of the concrete.

Sugarcane bagasse ash was used as an alternative for cement because of its similarity with portland cement: containing silica (SiO2) and Fernit (Fe203) that can be used as pozolan to substitute some parts of the cement and improve its compressure strength (Gemelly Katrina, 2014). Thus, it is being experimented as an alternative to parts of the cements, to see whether it will give positive impacts to the compressure strength.

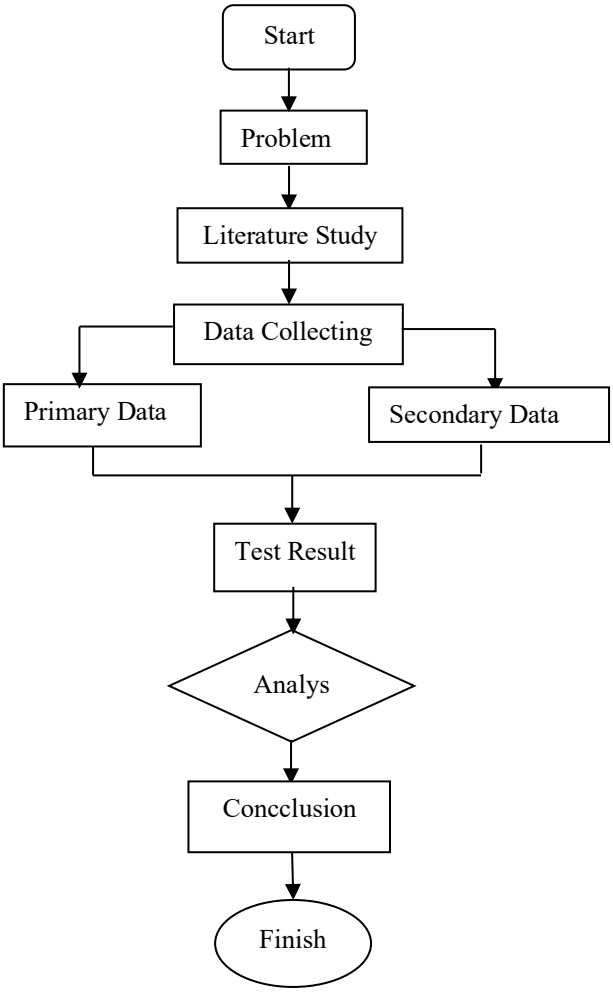
The writer's motivation in making this paper titled "The Use of Sugarcane Bagasse As A Complement to Compressure Strength for Concrete" is to make use od the sugarcane waste scattered around the writer's

environments; remnants of the sugarcane juice seller. Soon after the juices obtained, the sellers just disposed the bagasse to the final disposal. Hence, the writer thought about a possibility to recycle the bagasses, bringing some benefits to what was once thought as a mere trash. It is also interesting to note that in sugarcane sugar factories, the bagasses are burned along with the charcoal so as to be a bahan bakar for the sugarcane processor. Hence, there is no bagasse left in the factories.

RESEARCH METHOD

This research is conducted by testing several samples in a laboratorium of Universitas Islam Lamongan in accordance with data obtained from the bibliography, using concrete SNI standard. The sample made is fresh concrete made with comparative mixed composition using sugarcane bagasse ash as the the mixed concrete to substitute cement.

Elements or materials used in this research is sugarcane bagasse ash, coarse aggregate, fine aggregate, cement, and water. The stage of variables identification are then directly obtained and documented in the laboratory of Universitas Lamongan to keep its authenticity. In this research, the samples are then will be taken and collected to be tested in the laboratory of Universitas Lamongan so as to examine the contain in the materials, fine aggregate, coarse aggregate, cement, water, and other wood powders complement. In this matter the mix design will be conducted with concrete mixing plan method. Some parameters used in this research include: examining and researching the physical matters, the testing of its compressure strength by age 7 days, which will then being converted to 28 days.



RESULT AND EXPLANATION

The result and analysis are obtained from the research that was conducted in the civil engineering laboratorium of Universitas Islam Lamongan, which then being compared to the requirements given by the applied standards on concrete mixing. Materials used in this research are portland cement, coarse aggregate, fine aggregate, Limabu sugarcane bagasse 0%, 8%, 10%, 12%, and water,

Evaluation on Materials

a. Cement

According to the testing conducted in the civil engineering laboratory of Universitas Islam Lamongan::

1. The testing on cement consistency fulfilled the standard requirements around 285 (ASTM C 187-86), with 10 mm decrease of 70 cc of water to examine the wetness standard of the paste. The result of the consistency is equal to all of the testing because formula for the consistency testing was taken from:

$$Normal\ Consistency = \frac{\text{Water weight}\ \ x100}{Cement\ weight}$$

   Hence, there's no difference in treatment with the previous one.

2. Testing on the bonding and hardening time for normal cement without additional mix needs 120 minutes for standard, and this result is to acknowledge the time needed for the cement during the bonding time.
3. From the testing in berat jenis cement it is then obtained that average value is 2.329 gr. According to the requirement from SNI 15-2531-1991 berat jenis for cement must be around 3,00 – 3,20 t/m^3, hence the berat jenis for this cement wasn't qualified for the standard.

b. Coarse aggregate

Physical test on the coarse aggregate conducted in the laboratory of Universitas Islam Lamongan (UNISLA) showed that:

1. From the testing of the coarse aggregate mixture it is obtained that average moisture of the gravels= 1,265%. Dari hasil pengujian kelembapan agregat kasar diperoleh nilai kelembapan kerikilrata-rata= 1,265%. Ue to the absence of quality standard (ASTM C 566-98), the moisture obtained can be used in the mixed design.
2. From the testing of specific gravitty of the coarse aggregate, it is then obtained that the density of the gravels is about 2m37 gr in average. According to the quality standard of the density of the gravels (ASTM C 127-88-93)M it is obtained the value of 2,2 gr – 2,7 gr. Thus, gravels filled the requirements. From the testing of water catchment of the coarse aggregate it is obtained that the value of water catchment is aout 1,88 gr. According to the requirements for quality standard of the water catchment (ASTM C 127 – 8893) it is obtained 1-4% value. Hence, graves fit the requirements to be used.
3. From the testing of coarse aggregate volume it is obtained that the average weight value of of the testing in normal state, with rojokan, and with ketukan, is 1m432 kg. Standard requirement for the volume of the crushed stone according to (ASTM C 127 88-93) is 1m4 – 1,7. Hence, the weight volume of the aggregate in the testing filled the quality standard.
4. From the testing of the sieve analysis of the coarse aggregate it can be concluded that sieve data analysis of the rough aggregare valued in FM = 4,458%. And this value doesn't qualify the standard (ASTM C 33 – 98) that is 6 – 7%. Hence, the gradation in coarse aggregate is tend to be flat/not rough enough.

c. Fine aggregate

The result of testing fine aggregate conducted in the laboratory of civil engineering Universitas Lamongan is as follows:

1. It is obtained that average moisture for the sands is 5,605%. This value is relatively bigger than ASTM C 566 89 requirements that allow sands moisture < 0,1%. Hence, this fine aggregate doesn't qualify for the quality standard of ASTM C 566 – 89.
2. Testing on the density of the fine aggregate shows that its average value (from the two tests) is 2,62 gr/ dm$^{3.}$ According to the standard (ASTM C 128 – 78) the density of the sand required is around 2,4 – 2,7 gr/dm^3. Hence, the sand is deemed as qualified (ASTM C 128 – 78).
3. From the testing of water catchment in fine aggregate it is obtained average value of the two tests is 2m78%.
4. The average value of the density test in sand at its normal state, with rojokan, and with ketukan, is 1,359 gr/lt. This value is still at its standard marginm 1,2 gr/lt (SII No 52 – 1980) at minimal

Result of the sieve data from the analysis of fine aggregate is FM = 2,705%, and this value fits the quality standard (SK SNI S 04 1989 F) that is 1m5 – 3,8%. Hence, the gradation of this fine aggregate is at Zone 2.

- **Evaluation on Concrete Compressure by Age 28 Days After Corelation**

Table 2 Compressure Strength of the Concrete by Age 28 Days

Type of Concrete	Size (Cm)	Sectional Area(Cm^2)	Age (In Days)	Volume of the Cylindre (M2)	Weight(Kg)	Crushing Compressure (Kg)	Concrete Density (Kg/M^3)	Sb'i (Kg/Cm^2)	MPA Conversion	Average MPA
	F 15-30	176.625	7	0.0053	12.34	40000	2328.30	226.47	18.80	
Normal	F 15-30	176.625	7	0.0053	12.52	39000	2362.26	220.81	18.33	18.17
	F 15-30	176.625	7	0.0053	12.37	37000	2333.96	209.48	17.39	
B 8%	F 15-30	176.625	7	0.0053	12.34	32000	2328.30	181.17	15.04	
B 8%	F 15-30	176.625	7	0.0053	12.18	33000	2298.11	186.84	15.51	15.04
B 8%	F 15-30	176.625	7	0.0053	12.14	31000	2290.57	175.51	14.57	
B 10%	F 15-30	176.625	7	0.0053	12.3	21000	2320.75	118.90	9.87	
B 10%	F 15-30	176.625	7	0.0053	12.35	23000	2330.19	130.22	10.81	10.03
B 10%	F 15-30	176.625	7	0.0053	12.02	20000	2267.92	113.23	9.40	
B 12%	F 15-30	176.625	7	0.0053	12.07	18000	2277.36	101.91	8.46	
B 12%	F 15-30	176.625	7	0.0053	12.21	19000	2303.77	107.57	8.93	8.62
B 12%	F 15-32	176.625	7	0.0053	12.04	18000	2271.70	101.91	8.46	

From the result of the research it is obtained that the concrete compressure shows that in age 28 days there are some variations on the use of sugarcane bagasse ash waste at 0%, 8%, and 12% as follows. In the result of the testing on concrete compressure strength in normal state without any mix by age 28 days it is obtained that the average value of the 3 samples is 18,17 Mpa, and this value fits the requirements (ASTM C 832 – 75) as a K-175 quality concrete.

From the testing on compressure strength on the mix of 8% sugarcane bagasse ash at age 28 days it is obtained that average value of the 3 samples is 15,04 Mpa. And this value fits the requirements (ASTM C 832 – 75) as a K-175 quality of compressure strength concrete. For the result of compressure strength in concrete with 10% mix of sugarcane bagasse ashh in age 28 days, the average value from the 3 samples is 10,03 Mpa, and this value doesn't qualify for the standard (ASTM C 832 – 75) as a k – 175 quality concrete strength compressure. For the result of compressure strength of 12% mix of sugarcane bagasse ash at 28 days age from 3 samples obtained a value of 8,62% Mpa, and this value doens;t qualify the requirements (ASTM C 832 – 75) as a compressure strength for k – 175 quality concret.

Diagram of the Compressure Strength Age 28 Days after Correlation

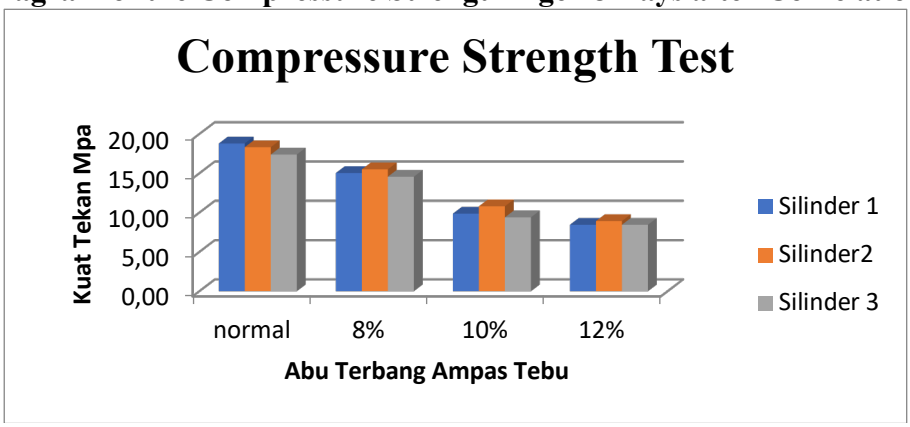


Diagram of the Compressure Strength Age 28 Days

From the picture 2 it is obtained that by age correlation of 28 days a 0% mix is valued in 18,17 Mpa, 8% mix of sugarcane bagasse is valued 12,04 Mpam and a mix of 10% sugarcane bagasse obtained 10.03 Mpa, a mix of sugarcane bagasse in 12% is valued 8,62 Mpa.

Hence, the comcrete that fits the standard of K-175 quality is a concrete with 0% mix of sugarcane bagasse ash with value 18,17 Mpa, and 8% mix of sugarcane bagasse ash with value 15,04 Mpa. Meanwile the 10% mix with value 10m01 Mpa, and 12% mix of bagasse ash in 8,62 Mpa don't fot the requirements of K-175 (14,5 Mpa).

Conclusion

From the research conducted it is obtained that compressure strength for concrete in age correlation 28 days with 0% mix is 18,17 Mpa, a 8% mix of sugarcane bagasse ash is 15,04 Mpa, and a 10% mix of sugarcane ash is 10,03 Mpa, and 12% mix of sugarcane bagasse ash is 8,62 Mpa.

For concrete that fits the standard of K-175 quality is concrete with 0% mix of sugarcane bagasse ash by value 18,17 Mpa, and 8% mix with 15m04 Mpa. While the 10% mix of sugarcane bagasse ash by value 10,03 Mpa, and 12% mix with value 8,62% Mpa doesn't qualify the standard for K-175 quality or 14,5 Mpa.

The use of sugarcane bagasse ash a mix of cement alternative towards compressure strength isn't quite suitable. And this is shown by the loss of compressure strength in accordance with the raise in percentage of sugarcane bagasse ash towards the concrete mix.

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