EFFECT OF ADDING POLYVINYL ACETATE AND COCONUT SHELL ON CONCRETE

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ABSTRACT

Manufacture of concrete with a mixture of coconut shell and polyvinyl acetate. The material used in this study are from the coconut shell coconut waste treatment process which is crushed to a maximum size of 20 mm, whereas polyvinyl acetate condition is milky white emulsion. This study uses laboratory experiments concrete according to standards ISO 7656: 2012 for normal concrete and developed into concrete innovation. Coconut shell as a substitute for gravel with a rate of 8% and 10%, while the addition of polyvinyl acetate in the amount of 8% and 10%. At the time of fresh concrete workmanship, testing the slump test to control the workability and homogeneity. Treatment (Curing) specimen is done by covering the paper specimens with wet cement. Compressive strength testing carried out during the 28 days of the test specimen. The results obtained on the compressive strength with the highest average percentage of materials such as concrete polyvinyl acetate 8% and 8% of coconut shell Amounting to 351 kg/cm² with an average density of 2199 kg/cm³. In each of the test object with a weight value is the quality efficiency in concrete polyvinyl acetate 8% and 8% of coconut shell.

Keywords : Polyvinyl Acetat, Coconut Shell, Curing

INTRODUCTION

Concrete structure is one of the most jobs in the world. Basically, the concrete has a composition of cement, sand, aggregate, and water (Asroni, 2010). Nowadays, aggregates widely available at a price that is economical and has the quality of different, however, aggregate usage continuously in the long term, lead to the depletion of aggregate primary qualities and need a greater awareness of nature protection (Dahri and Syavir, 2013). In addition, the use of cement bound concrete jobs. In the industrial sector of cement, the cement manufacturing process which releases CO₂ gas and energy needs will give effect to the presence of CO₂ in the air (Malhotra, 1999). Carbon dioxide gas is a gas that can cause global warming.

Indonesia is a country with an area of 3,585,599 ha of coconut plantations year (2015) with a value of production of 2,920,665 tons. The industrial sector, processed coconut on coconut fruit flesh alone and partly in the form of waste. One coconut palm waste is having a tough nature, light, absorb water, textured wood, it has a quality coconut shell as aggregates.

polyvinyl acetate is an adhesive for porous materials, especially wood with adhesion (adhesivitas) high. Such materials are commercially creamy white or yellow saturated with emulsion and wet conditions. The use of inorganic or organic PVAC with concrete to make a higher density (Matsuri, 2010).

RESEARCH METHODS

Coconut shell processing as aggregates, namely, first clean the shell of coconut fibers, then wash and dry in the sun to dry. The latter process is pounding with the results of the size of 5-20 mm.

Figure 1. Coconut Shell For Aggregate

The materials used include the following, coconut shells that have been though, Polyvinyl acetate used is the brand of "Rajawali" a milky white with the conditions of the emulsion, sand originating from Lumajang, gravel with a size of 10 mm and drug concrete brand "ADDITON" type superplast.

Figure 2. polyvinyl Acetat

Planning a material proportion of the concrete mixture using a mixture standards election planning ISO 7656:2012 with the results as a reference for normal concrete is developed into concrete innovation.

Table 1. Objects Formula Test

Test objects	Cement	Sand	Gravel	Coconut shell	PVAC	Water	SP
	(Kg)	(Kg)	(Kg)	(Kg)	(Kg)	(l)	(l)
Normal	380	1103	591	-	-	180	19
CS PVAC 8% +	380	1103	544	47.28	30.4	180	19

8%							
PVAC 8% + CS	380	1103	532	59.10	30.4	180	19
10%							
CS PVAc 10% +	380	1103	544	47.28	38.0	180	19
8%							
CS PVAc 10% +	380	1103	532	59.10	38.0	180	19
10%							

Preparation of test specimens made as many as 20 pieces in the shape of a cube, each made with five variations of the test specimen and four specimen at each variation. The test object in the form of a cube having a side of 15 cm.

In the mixing stage, *polyvinyl acetat* dissolved into some of the water in the container, then soak the coconut in the container for 15 minutes to 30 minutes. At the time of stirring reserving some of the water, before the drug mixed concrete. After achieving a homogeneous fresh concrete, testing slump. In the maintenance phase of the test specimen, performed after a day old by covering the test object with cement soaked paper.

Compressive strength testing performed on the test specimen 28 days, after the drying process of care test object. Compressive strength testing conducted at the Laboratory of Civil Engineering Concrete Narotama University.

Quality relationship with a weight equal compressive strength (f_c) divided by density (kg/m^3). The equation to determine an efficient compressive strength against weight. The more lightweight concrete with high compressive strength value then becomes the ideal value.

RESULTS AND DISCUSSION

Stage of the examination or test performed on the laboratory aggregate Concrete Civil Engineering Narotama Surabaya. Testing fine and coarse aggregates include moisture, density, volume weight, hygiene, sieving, as the following table;

Table 2. Aggregate testing

This type of testing	Smooth	Rude
humidity sand	1.7%	0.5%
Bulk specific gravity	2:39	
Weight of saturated surface dry	2:48	2:35
Apparent specific gravity	2.60	
water absorption	1:24%	7.76%
Heavy volume (rojokan)	1.81	1:33
Cleanliness sludge (precipitation)	2.1%	5.5%
Cleanliness mud (laundering)	4.2%	
Fine grain Modulus	3:02	2:57

At the time of setting time, *polyvinyl acetat* has a long drying properties to the wet, while the SP (Superplast) is accelerating the hardening. At that time experienced a hard concrete surface but the conditions are not yet fully hard inside.

Concrete treatment processes (curing) by covering the test object with wet cement and paper soaked in water. Wood textured coconut shell that can absorb water, if soaked the coconut shells become obsolete and will decrease the compressive strength of the test specimen.

In testing the compressive strength, compressive strength is obtained as follows;

Table 3. Aggregate testing

test specimen	Specific gravity	compressive strength	Specific gravity Average	compressive strength Average
	(Kg/m ³)	(Kg/cm ²)	(Kg/m ³)	(Kg/cm ²)
Normal	2008.9	144.44	2025	237
	2009.5	266.67		
	2056.9	297.78		
	2023.4	240.00		
CS PVAC 8% and 8%	2168.0	293.33	2199	351
	2211.6	333.33		
	2221.0	400.00		
	2196.7	377.78		
PVAC 8% and 10% CS	1973.6	253.33	2003	236
	1979.0	242.22		
	2025.5	235.56		
	2032.9	213.33		
CS PVAc 10% and 8%	2138.4	273.33	2143	288
	2213.0	311.11		
	2069.0	26 667		
	2151.4	300.00		
CS PVAc 10% and 10%	2048.0	222.22	2113	267
	2109.0	297.78		
	2113.2	231.11		
	2182.8	315.56		

The influence of the addition of coconut shells in concrete, can be seen in the following chart;

Figure 3. Compressive Strength Test Objects

A normal concrete compressive strength is an average of 237 kg / cm². Test specimen polyvinyl acetate and coconut with a proportion of 8% and 8% have a compressive strength of 351 kg / cm², the addition of 10% polyvinyl acetate and the result has decreased by 236 kg / cm². While the specimen at a proportion of 10% polyvinyl acetate and 8% coconut has a compressive strength of 288 kg / cm², the addition of 10% polyvinyl acetate and the result is decreased by 267kg / cm². If the note is the addition of coconut decreased compressive strength

Table 4. Relationship Quality and Density

Test objects	Compressive Strength (Fc ')	Specific gravity (Kg / m ³)	Compressive strength / density (Fc ') / (kg / m ³)
Normal	237	2025	0117
PVAC 8% + CS 8%	351	2199	0159
PVAC 8% + CS 10%	236	2003	0118
PVAc 10% + CS 8%	288	2143	0134
PVAc 10% + CS 10%	267	2113	0126

In Table 4, obtained the value of quality efficiency with a specific gravity that is in material polyvinyl acetate 8% and 8% coconut shells with an average compressive strength of 351 kg / cm² and a density of 2199 kg / m³.

CONCLUSION

On the results of research and discussion that has been done can be some conclusions as follows:

1. Influence of the concrete to the addition of coconut shells are heavy concrete may be light, but the addition of coconut shell by 10% decreased the compressive strength compared to the addition of coconut shells at 8% with the compressive strength of 236 kg / cm² of 351 kg / cm² and 267 kg / cm² of 288 kg / cm². Meanwhile, the effect of the addition of polyvinyl acetate as the added material that can bind coconut shells with concrete because the adhesion properties of polyvinyl

acetate, but at the time of setting time, the influence of polyvinyl acetate which makes the concrete hardens longer than normal concrete.

2. In this study, the planned compressive strength is equal to 200 kg / cm² with a safety factor of 250 kg / cm². On the results obtained value of the compressive strength of the average on the test object with the proportion of ingredients, among others, specimen concrete polyvinyl acetate 8%, coconut shell 8% achieved compressive strength of 351 kg / cm², the test specimen concrete polyvinyl acetate 8%, coconut shell 10% achieved compressive strength of 236 kg / cm², while the test specimen concrete polyvinyl acetate 10%, coconut shell 8% achieved compressive strength of 288 kg / cm², and the test specimen concrete polyvinyl acetate 8%, coconut shell 10% achieve strong press at 267 kg / cm².
3. The optimum mix design in terms of density and compressive strength of the concrete specimen is at 8% polyvinyl acetate, coconut shell 8% with average density of 2199 kg / m³ and a compressive strength of 351 kg / cm².

ACKNOWLEDGMENTS

In order to produce research which will be better in the authors suggest further research attention to the following:

1. In the early stages of preparation of materials, especially coarse and fine aggregate, aggregate that has been washed and was in a state of SSD, should be placed in a genuinely can retain up to an aggregate SSD condition ready for use.
2. In order to get the proper mixing there should be further studies on the properties of the concrete example of trial and error.
3. It should be noted at levels of added water if using a material such as superplast, accident on the water level is high enough.

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