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Analysis of The Compressive Strength of K 225 Concrete Using Palm Oil Shell Waste as A Particular Replacement of Coarse Aggregates High School Of Indragiri Rengat Technology

Pirman Jaka Wiranta*, Sri Agustin, Lisa Trisnawati
Sekolah Tinggi Teknologi Indragiri
Correspondent Email: Pirmanjaka@gmail.com*, sriagustin1402@gmail.com, trisnalisa0301@gmail.com

ABSTRACT

Sand, coarse aggregate, and fine aggregate make up the building material known as concrete. Cement and water are used to bind these components together. The production of building construction is the typical application for using concrete (Atamini & Moestafa, 2018). In this study, researchers used a combination of 1%, 3%, and 5% shells from palms at ages 7, 14, and 21 days to measure the compressive strength of concrete using quality K-225. Concrete that is 21 days old or older because, according to PBI 1974, the strength of concrete is nearly 100% at this age. According to the results of the compressive strength test, the compressive strength of the 1% concrete mixture after 21 days was 238.40 kg/cm 2, the compressive strength of the 3% mixture after 21 days was 236.58 kg/cm 2, and the compressive strength of the 5% mixture after 21 days was 219.44 kg/cm 2. The inclusion of palm shells for quality K-225 can be employed at a mixture of 1% to 3% to obtain the required compressive strength, as can be observed from numerous modifications in the percentage of the combination.

Keywords : compressive strength, aggregate, palm shell.

PRELIMINARY

Concrete is a building material consisting of fine aggregate, coarse aggregate and sand as its constituents which are bound using cement and water. The usual application of using concrete is for the manufacture of building construction (Atamini & Moestafa, 2018) . Normal concrete that is commonly used has a strength ranging from 200 kg/cm2 to 500 kg/cm2. The concrete material commonly used in concrete mixes is coarse aggregate derived from stones with a size of 1-4 cm (Suprapto, 2008).

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Oil palm solid waste, especially palm shells (CKS), is still very minimally used by the community. The most frequently used CKS is as fuel for household needs and for the manufacture of activated charcoal (Dwi, 2010). As a result of the minimal use of CKS, there is accumulation of CKS waste in palm oil processing factories which can pollute the environment. CKS waste comes from CPO (*Crude Palm Oil*) processing plants which are used as boiler fuel, the use of CKS fuel contains 28% CKS (Mahidin, 2009).

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The use of CKS waste as a concrete mixture will add alternative construction materials and can also increase the use of this concrete mixture so that research is needed to determine the effect of additions to concrete and the use of CKS as a substitute for coarse aggregate (coral). Palm shell waste is waste from palm oil mills, usually used as an additive for fuel. The use of palm shell waste as a concrete mixture is due to the hard structure of the shell and the ends of the shells which are fibrous so that it can be expected as a substitute for aggregate and fillers in concrete.

In order to achieve the above purpose, an analysis of the compressive strength of K225 concrete is carried out using palm shell waste as a substitute for coarse aggregate, which will be tested in the laboratory of PT. INTI INDOKOMP.

From the research that has been carried out and from the results that have been achieved by the research of Acmad Syarifudin, Mega Yunanda, Cristina Anjani, the results are: The evaluation value of the compressive strength achieved by concrete without using coarse aggregate or normal concrete at the age of 28 days obtained a compressive strength of 231.73 kg/cm2. Evaluation value The compressive strength achieved by concrete using palm shell waste or 5% coarse aggregate replacement material for compressive strength at 28 days was 217.39 kg/cm2. The compressive strength evaluation value achieved by concrete using palm shell waste or 10% coarse aggregate replacement material for compressive strength at 28 days of age was 164.55 kg/cm2. The compressive strength evaluation value achieved by concrete using palm shell waste or 15% coarse aggregate replacement material for compressive strength at 28 days of age was 153.98 kg/cm2.

From this, the author wants to examine more deeply about the Compressive Strength Analysis of K-225 Concrete Using Palm Shell Limba As A Partial Substitute for Coarse Aggregate, Using a Mixture of 1%, 3%, 5% Palm Shell Shells.

Theoretical basis

Concrete is a building material consisting of coarse aggregate, fine aggregate which is bound together using water and cement, *admixture* or *additives are often added* when needed. DPU-LPMB defines concrete as a mixture of portland cement or other hydraulic cement, fine aggregate, coarse aggregate and water, with or without additional admixtures which form a solid mass (SNI 2847: 2013, 2013)

Concrete is the most commonly used building material. In construction, concrete has a very important role. The strength of the concrete structure determines the age of a building. In addition to being the main structure, concrete has plastic properties that allow it to be molded according to the desired shape. Concrete has high compressive strength and no settlement

Oil palm shells are waste from mills that result from palm oil milling. So far, some of the palm oil waste has been utilized but still leaves quite a lot of residue,

meaning that palm oil mill processing waste in the form of palm kernel shells has not been utilized optimally. In this study, oil palm shells. This study aims to determine the maximum compressive strength of concrete achieved from a mixture of palm shells.

The research materials used for the concrete mixture are: *Pozzolanic portland cement* (PPC), fine aggregate, namely Sand from Ringgit Sand, Indragiri Hulu District, The water used is water from the Laboratory of PT. INTI INDOKOMP, and as an additional material, namely palm shell waste from the Kab. Indragiri Hulu.

Concrete Specifications

Concrete used as a structure in civil engineering construction can be used for many things such as building foundations, columns, beams, floor slabs. In civil hydro engineering, concrete is used for water structures such as dams, canals and drainage. Concrete is a function of the constituent materials consisting of hydraulic cement (*Porlantd Cement*), coarse aggregate, fine aggregate, water, and added materials (*admixture or additive*) [9]. The mixture will harden like rock, hardening occurs due to chemical reactions between cement and water.

Concrete Mixing Materials

1. Cement

Cement is a mixed material which is chemically active after contact with water. Aggregate does not play an important role in the chemical reaction, but functions as a mineral filler that can prevent changes in concrete volume after mixing is complete and improve the durability of the resulting concrete (Mulyono, 2004).

2. Fine Aggregate

According to SNI 03-2847-2002 fine aggregate is natural sand as a result of 'natural' disintegration of aid or sand produced by the stone crushing industry and has the largest grain size of 5.0 mm

3. Water

Water is needed in the manufacture of concrete to trigger the cement chemical process, wet the aggregate and provide convenience in concrete work. The function of water in the concrete mix is to trigger the chemical process of cement as an adhesive and lubricate the aggregate so that it is easy to work with. The quality of the water used to mix the concrete greatly influences the quality of the concrete itself.

4. Palm Shell

Palm shell is a waste from a palm oil mill , here it becomes an additional ingredient in the concrete manufacturing process which aims to utilize waste from palm shells and has an influence on the compressive strength of the concrete mix.

Strong Press

In this study, the compressive strength was tested on several mortar samples, which will be oriented towards determining the high and low compressive strength of the concrete from the results of the compressive strength test with concrete ages of 7, 14 and 21 days.

RESEARCH METHODS

This research was conducted using an experimental method, namely research that aims to compare the compressive strength and volume of concrete with a mixture of coarse aggregate using new gravel and concrete with a mixture of coarse

aggregate using a mixture of palm oil shells, and to find out the right mixture in order to get the optimum compressive strength of the mix.

Material

The materials used are as follows:

1. Cement
   The cement material used in this study was PPC cement from the Semen Padang brand.
2. Sand
   The sand used in this research is Japura Sand, Indragiri Hulu Regency.
3. Water
   The water used in this study is clean water that does not contain harmful chemicals, contains salt, oil, which is sourced from PT. INTI INDOKOMP.
4. Palm shells.
   The palm shell waste used in this study came from oil palm plantations in the Indragiri Hulu area.

Concrete Test Material

Preparation

In carrying out research it is necessary to make preparations including permitting laboratory use, collecting materials or taking material samples, preparation of research tools, and preparation of data entry blanks.

Aggregate Inspection

The examination of the aggregate material in this study consists of :

a. Sieve analysis .
b. Check specific gravity and aggregate absorption.
c. Water level check.
d. Sludge level check.

Preparation of Test Objects

Concrete test specimens were made using a cube measuring 15 cm x 15 cm with 27 sample specimens.

Examination of Moisture Content

Moisture content testing was carried out for 7 days, 14 days, and 21 days. This inspection is carried out by taking the aggregate, then placing it in *the oven* and then weighing it before and after being in *the oven* . The results of the scales are compared and multiplied by 100%.

Data Analysis

Analysis of independent compressive strength test data in this study refers to SNI 3638:2012. The number of test objects as many as 27 samples.

Material Manufacturing Procedure Concrete Test

The procedure for making mortar test materials, which consists of:

1. Mixing
   Materials such as cement and sand are weighed in a ratio of 1: 2.75 and palm shells are 1%, 3% and 5% by weight of cement.
2. dough

After all the ingredients are mixed, water is added to the middle of the dough and left for 60 seconds so that the mixture bonds with each other and then the mixture is stirred until the mixture is completely homogeneous.

3. Printing

After the dough is finished, it is printed using a 15 x 15 x 15 mm cube mold

Concrete Compressive Strength Testing Procedure

Concrete pressure strength test is carried out to determine the crushed compressive strength of the specimen. The test object used is a cube with side dimensions (15 x 15 x 15) cm. Concrete pressure strength testing was carried out when the concrete was 7, 14 and 21 days old.

This procedure is repeated for other samples of compressive strength test specimens. Compressive strength can be obtained by the formula, as follows:

Fc=P/A ....

Information:

Fc : Compressive strength of the specimen (kg/cm2)

P : Maximum compressive load (kg)

A : Area of compression (cm2)

4. Strong Press

The compressive strength of concrete is the ability of concrete to withstand external forces coming in a direction parallel to the fibers which will then put pressure on the mortar. The concrete used for building materials must have strength, especially for brick wall pairs, brick pairs or other wall pairs. Concrete compressive strength is represented by the maximum compressive strength in MPa units. The compressive strength is calculated by the formula:

Concrete compressive strength

Σm = P max / A .. ..

Information:

f'c (σm) = Concrete compressive strength (Mpa)

Pmax = Maximum compressive force (N)

A = cross-sectional area of the test object (mm2)

RESULTS AND DISCUSSION

Fine Aggregate Inspection

Purpose conducted inspection characteristic physical aggregate fine is for know characteristics aggregate fine which will used as materialcomposer concrete. As material composer concrete, aggregate fine have rolewhich very urgent in influence strength concrete

TESTING SPECIFIC WEIGHT AND FINE AGGREGATE ABSORPTION

Name Sample : Sand

No	Number Example			A	B	Unit
1	Heavy thing test dry saturated surface (Bj)			500	500	**grams**
2	Heavy pycnometer + water (Ba)			670,80	668.50	**grams**
3	Heavy pycnometer + water + thing test (BT)			972.0	973.0	**grams**
4	Heavy thing test dry oven (Bk)			496,1	492.5	**grams**
No	Results	Formula	A	B	Average	**Spec**
1	Specific gravity (*Bulk*)	$\frac{Bk}{Ba - Bj - Bt}$	2,495	2,519	2,507	-
2	Specific Gravity (SSD)	$\frac{Bj}{Ba - Bj - Bt}$	2,515s	2,558	2,536	-
No	Results	Formula	A	B	Average	**Spec**
3	Specific Gravity (*Apparent*)	$\frac{Bk}{Ba - Bk - Bt}$	2,545	2,620	2,583	-
4	**water absorption(*Absorption*)**	$\frac{Bj - Bk}{Bk} \times 100$	**0.786**	**1,523**	**1.154**	**Max 3**

Test Content Mud Aggregate Fine

According to Condition General Ingredients Building in Indonesia 1982 (PUBI1982)Article 11 sand which can be used for building materials if it contains the mud no more from 5% (five percent). From Table 4.2 could seen silt content in the sand of 0.92%. After this means the sand directly used in the manufacture of concrete without having to be washed first formerly

Inspection Mud Sand			
Description		**Results Observation**	
		Sample 1	**Sample2**
A. High sand + mud		485	495
B. High sand		482	489
C. Mud height	A+B	3	6
D. Rate mud %	(C/A)x100	0.62	1.21
Rate mud flat - flat %	(D1+D)/2	0.92	

Coarse Aggregate Inspection

Examinations carried out for coarse aggregate include moisture content, silt content, specific gravity and absorption, sieve analysis. The coarse aggregate used is Pasir Ringgit coral. From the results of the examination that has been carried out, the following data is obtained:

TESTING SPECIFIC WEIGHT AND FINE AGGREGATE ABSORPTION

Name Sample : Sand

No	Number Example	A	B	**Unit**
1	Heavy thing test dry saturated surface (Bj)	1985,6	1249.3	**grams**
2	Heavy pycnometer + water (Ba)	1229	774,1	**grams**
3	Heavy pycnometer + water + thing test (BT)	1976,7	1243	**grams**
4	Heavy thing test dry oven (Bk)	1985,6	1249.3	**grams**

No	Results	Formula	A	B	Average	**Spec**
1	Specific gravity (*Bulk*)	$\frac{Bk}{Ba - Bj}$	2,613	2,616	2,614	-
2	Specific Gravity (SSD)	$\frac{Bj}{Ba - Bj}$	2,644	2,651	2,647	-
No	Results	Formula	2,624	2,629	2,627	**Spec**
3	Specific Gravity (*Apparent*)	$\frac{Bk}{Ba - Bk}$	0.450	0.507	0.479	-
4	**water absorption (*Absorption*)**	$\frac{Bj - Bk}{Bk} \times 100$	**2,613**	**2,616**	**2,614**	**Max 3**

Test Content Mud Aggregate Rough

According to Condition General Ingredients Building in Indonesia 1982 (PUBI1982)Article 11 Coral which can be used for concrete if it contains the mud no more from 1% (One percent). From Table 4.6 could seen the mud content in coral is 0.87%. After this means the Coral directly used in the manufacture of concrete without having to be washed first formerly.

Inspection Mud Sand			
Description		Results Observation	
		Sample 1	Sample2
A. High sand + mud		2000	2025
B. High sand		1985	2005
C. Mud height	A+B	15	20
D. Rate mud %	(C/A)x100	0.75	0.99
Rate mud flat - flat %	(D1+D)/2	0.87	

Mix Design

Based on the results of the mix design , the proportion of material needed to be used for each variation of the mix for 1 m ^{3} is obtained . The following is a comparison of the total amount of material needed for each variation of the mixture using palm shells:

No.	Material	Unit	Heavy		
			1%	3%	5%
1.	Cement	kg	10,3	10,3	10,3
2.	Water	kg	4,8	4,8	4,8
3.	Coral	kg	37.0	35,8	34,7
4.	Palm shells	kg	0.6	1,7	2,9
5.	Sand	kg	20,2	20,2	20,2

Concrete *Slump* Testing

it can be seen that the results of the *slump* test achieved starting from concrete with a mixture of palm shell waste, as a substitute for coarse aggregate 1%, 3%, 5% still meet the required slump of 10 cm. for maximum and minimum slump values, namely: 7.5-15.0 cm for concrete work (LPMB, 1971).

Types of Concrete Testing	Slump Value(cm)
Concrete with the addition of 1% palm shell	10
Concrete with the addition of 3% palm shell	10
Concrete with the addition of 5% palm shell	10

Compressive Strength Testing

Concrete compressive strength testing is carried out to find out how much concrete compressive strength is produced by the sample being tested, whether the

required compressive strength value is obtained or not. Based on the results of tests conducted at the PT. Core Indokom, concrete compressive strength results obtained at the age of 7, 14, 21 days.

Average Concrete Compressive Strength	Variation		
	Coarse Aggregate Substitute 1 %	Coarse Aggregate Substitute 3 %	5% Coarse Aggregate Substitute
Age Day 7	225.67	213.82	208,47
Age 14 Days	230.53	226.50	217,22
Age 21 Days	238,40	236.58	219.44

CONCLUSIONS AND SUGGESTIONS

Conclusion

From the research that has been done on the compressive strength of concrete with palm shell as a partial replacement for coarse aggregate with various percentages, it can be concluded The use of various variations of palm shell as a partial substitute for coarse aggregate has several effects, among others, at a percentage variation of 1% with 7 days of age it produces a compressive strength of 225.6 kg/cm $^{2.}$, while 14 days of age produced a compressive strength of 230.53 kg/cm ^{2}, and 21 days of age produced a compressive strength of 238.40 kg/cm ^{2}, at a percentage variation of 3 % with 7 days of age produces a compressive strength of 213.82 kg/cm ^{2}, while 14 days of age produces a compressive strength of 226.50 kg/cm ^{2}, and 21 days of age produces a compressive strength of 236.58 kg/cm ^{2}, and compressive strength at a percentage of 5% with 7 days of age produces a compressive strength of 208.47 kg/cm ^{2}, while 14 days of age produces a compressive strength of 217.22 kg/cm ^{2}, and 21 days of age produces compressive strength of 219.44 kg/cm ^{2}, From various variations in the percentage of the mixture, it can be seen that the addition of palm shells for quality k225 can be used from a mixture of 1% to 3%, to achieve the specified compressive strength.

Suggestion

From the research that has been done on the compressive strength of concrete by utilizing shells palm oil as a partial substitute for coarse aggregate, the researcher would like to convey some suggestions related to this research, including the following:

1. Future researchers can examine the compressive strength of concrete with an age of more than 21 days.
2. To keep the oil palm shells useful, new innovations should be made in the manufacture of concrete mixtures, so that there is no buildup at the factory site.

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