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The Effect of Palm Fiber as a Material of Added Fiber and Charcoal Powder as Cement Subtitution Against Strong Concrete Press

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Abstract

Palm fibers are natural fibers that are difficult to rot because there is no decomposer that can decompose the fibers. In addition, in Indonesia there are a lot of palm plants where the fibers are taken from the tree. The charcoal briquette powder is the fine grains of briquette charcoal that is mashed and contains silica. This study aims to determine the effect of using palm fiber as an added material for fiber and charcoal briquette powder as a substitute for cement in the concrete mixture on the compressive strength of concrete. This study uses a mixture of palm fiber as much as 0.75 %, 1.50 %, 1.75 % and 2.75 % from the weight of fine aggregate, as well as charcoal briquettes powder 5 %, 5 %, 10 %, and 15 % of the weight of cement. The compressive strength test was carried out on the 7th, 14th, 21st, and 28th days. The highest compressive strength value was obtained in variation V.2 with a mixture of 2.75% palm fiber + 5% briquette charcoal powder on the 21st day of testing of 20.02 Mpa

Keywords:
Charcoal Briquettes Powder, Compressive Strength, Concrete, Palm Fibers

1. Introduction

Efforts to improve the quality and quality of production products, both large and home industry (home industry) continue to be pursued. Along with this, the demand for quality and quality of production is increasing (Patra, 2003). The selection and use of concrete as a construction material is due to its effectiveness factor and efficiency factor. In general concrete is made of materials that are easy to obtain, easy to workability and have durability and strength that is indispensable in a construction. And with the development of concrete technology in the field of construction we must pay more attention to quality standards and effectiveness of work or for other purposes such as energy saving or saving of natural resources that can participate in improving a development. Therefore this construction material is considered very important to continue to be developed. One of the development efforts is by improving the properties of concrete weakness.

In this study with the addition of palm fibers and charcoal powder as a mixture into the concrete mix is expected to increase the strength of concrete in improving the press capability of concrete. Charcoal and palm fiber are ingredients that are abundant in Indonesia but have not been utilized optimally. Palm fibers can be used as an alternative booster for composite materials. Palm fibers are black and clay fibers, which are found at the base and rim of palm trees (Soeseno, 1992). The results of Yuwono, (1994) also prove that the addition of palm causes test objects (tile and wall panels) not to break shock when weighed. And Randing, (1995) in his research said the addition of palm fibers to the manufacture of concrete roof tiles has been shown to improve the properties of mechanical physics, such as increasing bending strength and reducing its regas properties. And in the research Hani Purwanti., S.T., M.T and Galih Widyarini, S.T, (2017) concluded that the use of charcoal that has elements of silica content, can be used as an alternative to a mixture of partial cement substitutes on K-200 concrete. Although the value of the strong trend press does not increase, however, the resulting strong press still meets the K-200. Therefore, it is hoped that this research can help the above problems by optimizing the utilization of palm fibers and charcoal powder as an alternative material of concrete making mixture.

2. Methodology

2.1. Materials

In this study the constituent materials on the concrete mixture are as follows:

a. The charcoal used is a type of charcoal briquette, then charcoal is smoothed as a mixture of cement.
b. Palm fiber used is kawung Palm fiber.

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c. The cement used in this study is type 1 cement – OPC of Gersik cement
d. The water used comes from UMB Civil Engineering Laboratory.
e. The sand used in this study is sand derived from Lampung
f. The pebbles used in this study were gravel or split stones

Figure 1**.** Charcoal Powder Briquettes

Figure 2. Palm Fiber

2.2. Method

In this study, researchers used experimental methods by mixing free and bound variables. The free variables in this study were palm fiber (X_1) and charcoal powder briquettes (X_2) while the bound variables werestrong press concrete (Y). 0.75%, 1.50%, 1.75%, and 2.75% of the sand weight for the fiber variation, and 0%, 5%, 5%, 10%, and 15% of the cement weight for the briquette charcoal powder variation.

The first test step is to prepare the necessary tools and materials. After that the material is tested in accordance with the applicable testing standards. The next stage is the calculation of mix design. After mix design calculation the next step is to do a trial mix. At the trial mix stage required a slump test to find out the workability of fresh concrete. If the slump test is qualified, the concrete can be printed 15x30 cm cylinder and wait until dry or ±24 hours new mold can be opened. The next stage is the curing process by soaking in the water tub until the appointed day. Before testing a strong press, the concrete should be removed from the tub and dried first. Strong press testing is carried out on the 7th, 14th, 21st, and 28th day of concrete life, after all stages of testing are done the last stage is analyzing and collecting the results of the test conducted.

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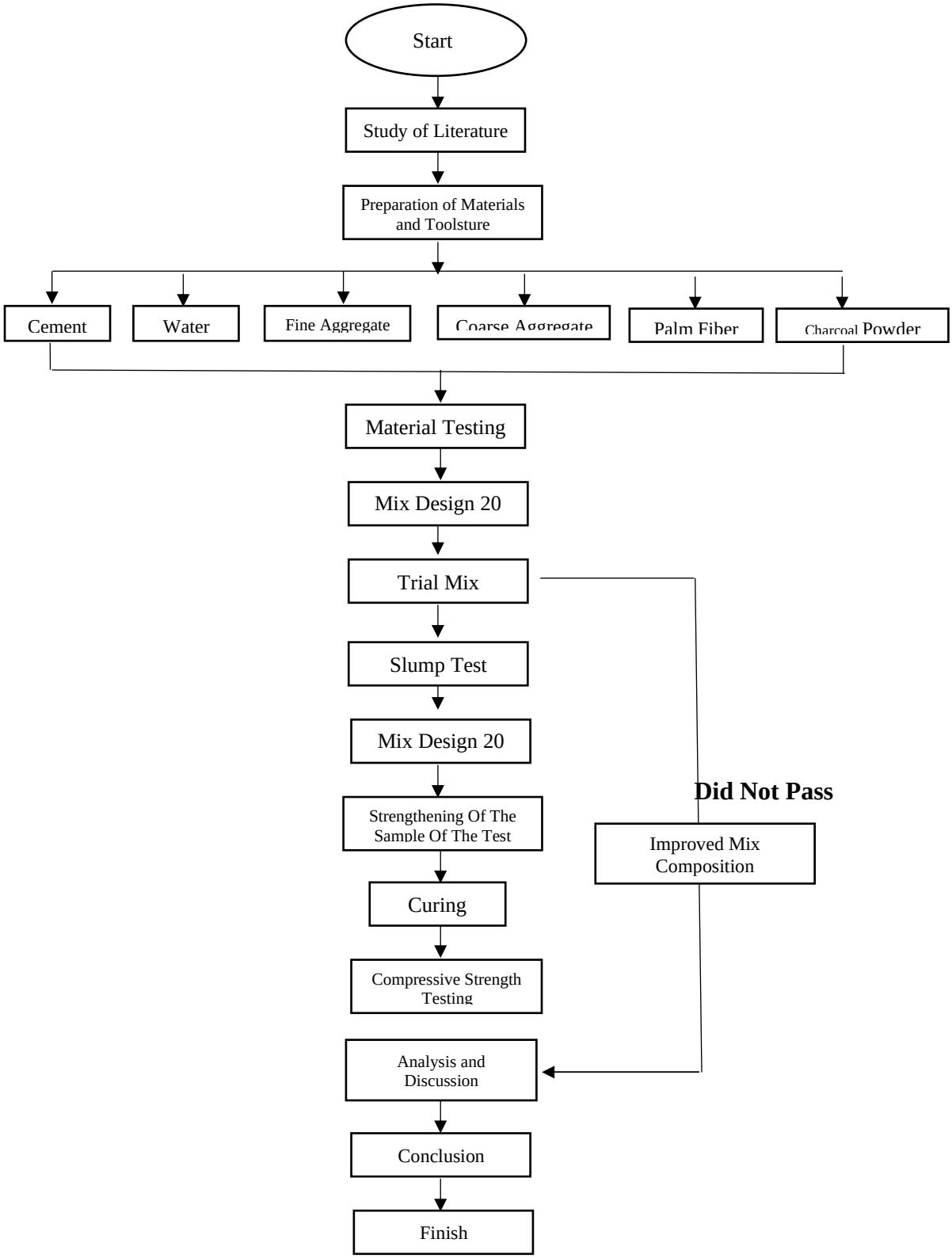

Figure 3. Research Flowchart
Source: Research Data

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Table 1. Material requirements for 1m³ concrete with quality 20Mpa

Materials	**Needs(kg/m^3)**
Cement	162,94
Water	78,21
Sand	187,52
Gravel	482,43

The research was conducted as many as 4 variations of the mixture plus normal concrete as concrete control. Each variation per day is 3 samples. So, a total of all variations plus normal concrete as many as 60 samples. Here is the number of material needs for each cylinder 15x30 cm:

Table 2. Material needs for 1 cylinder 15x30 cm

Variation Name	Variation Percentage		Cement	Sand	Gravel	Water	Palm Fiber	Charcoal
	Palm Fiber	Charcoal	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)
Normal	0%	0%	2,72	3,13	8,04	1,3	0	0
V.1	1,50%	5%	2,584	3,13	8,04	1,3	0,04695	0,136
V.2	0,75%	5%	2,584	3,13	8,04	1,3	0,02348	0,136
V.3	1,75%	10%	2,448	3,13	8,04	1,3	0,05478	0,272

2.3. Research Place and Time

Venue: Laboratory and Building Materials Civil Engineering Study Program, Faculty of Engineering, Mercu Buana University Bekasi Campus D.

When: May 2020 to July 2020

3. Result and Discussion

3.1 Fine agrega gradation testing

Fine aggregate gradation testing aims to know the gradation of grains ofsand. Please note that fine aggregate granules pass in sieve No. 100. Here are the results of fine aggregate gradation testing:

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Table 3. Fine Aggregate Gradation Testing Material Weight 2000 gr

Filter	Weight Restrained (gram)	Amount of Weight Held	Number of Percent	
			Stuck	Passing
50.80 (2”)				
25.40 (1”)				
19.10 (3/4”)				
6.3 (1/4”)	-	-	0	100
No. 4	0	0	0	100
No. 8	10	10	0,5	99,5
No. 12	30	40	2	98
No. 16	30	70	3,5	96,5
No. 30	350	420	21	79
No. 50	1100	1520	76	24
No. 80	380	1900	95	5
No. 100	30	1930	96,5	3.5
No. 200	40	1970	98,5	1,5
PAN	30	2000	10	0

3.2. Rough Aggregate Gradation Testing

Rough aggregate gradation testing aims to find out the gradation of gravel granules. Please note that rough aggregate granules are held in filter No. 4. Here are the results of the rough aggregate gradation test:

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Table 4. Rough Aggregate Gradation Testing Dry Material Weight = 1390 kg

Filter	Weight Restrained (gram)	Amount of Weight Held (gram)	Number of Percent	
			Stuck	Passing
11/2”	0	0	0	100
1”	0	0	0	100
3/4”	830	830	59,71	40,29
1/4”	370	1200	86.33	13.67
No. 4	190	1390	100	0
No. 8	0	1390	100	0
No 12	0	1390	100	0
No. 16	0	1390	100	0
No. 30	0	1390	100	0
No. 50	0	1390	100	0
No. 100	0	1390	100	0
No. 200	0	1390	100	0
PAN	1390	1390	100	0

3.3. Slump Testing (Workability)

Testing of slump (workability)is necessary to know the level of fresh concrete kelecakan. The higher the slump value, the more diluted the concrete and easier to work with, and vice versa.

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Table 5. Average Slump Testing

Variations	SLUMP VALUE
Normal	10
V.1 (1.5% + 5%)	10
V.2 (0.75 % + 5 %)	11
V.3 (1.75 % + 10 %)	10
V.4 (2.75 % + 15 %)	10

3.4. Strong Concrete Press Testing

Strong concrete press testing is carried out using a press test tool with 12 concrete samples of each variation. 3 samples on day 7, 14, 21, 28. Here are the results of the powerful test press:

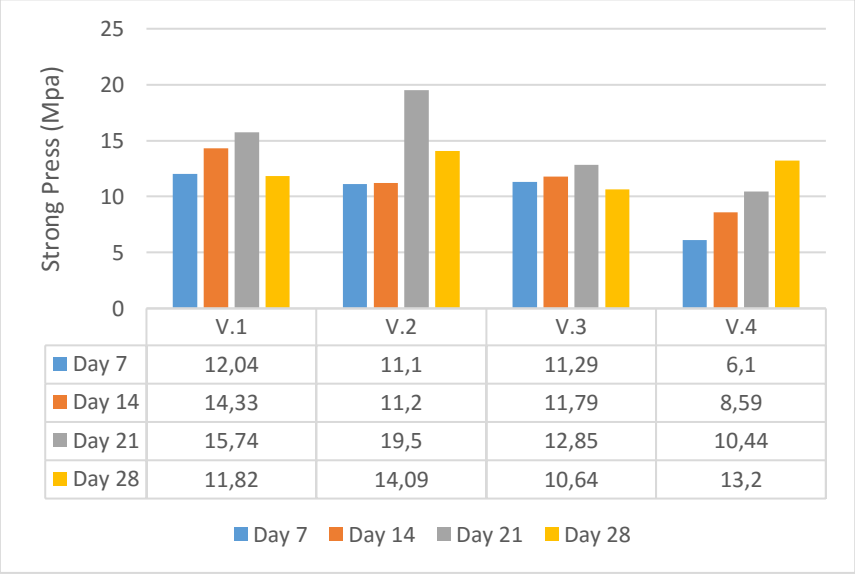

Figure 4. Strong Concrete Press Results
Source: Research data

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4. Conclussion

1. Based on the chart of concrete press test results shown above, the results of the normal concrete press strong test increased from day 7 to day – 28, on the test strong press variation V.1 strong value press increased but on the test day – 28 strong value press down, on the test strong press variation V.2 strong value press day to – 7 and day to 14 did not experience a large increase in value strong press, and strong test press day to – 21 strong value press up but test day to – 28 value strong press down. In the test strong press variation V.3 strong value press up until day to 21 and on the day to – 28 value strong press down, on the test strong press variation V.4 strong value press experienced an increase in all days strong test press but the strong press value obtained was not large or not as expected. In some strong press tests on the day to – 28 value strong press down due to concrete maintenance or curing of concrete struck by other concrete with a long time and it affects the strong value of the concrete press, because the place or tub curing is insufficient then the concrete is stacked at the time of the concrete curing process.
2. Based on the results of research and testing, the highest average slump value is found in variation V.2 with fiber percentage pal fiber 0.75% and charcoal briquette 5% which is 11 cm.
3. The addition of 0.75% fiber and 5% briquette charcoal on the strong test press day to – 21 got the highest press strong value of 20.02 Mpa and the average strong press variation V.2 on the 21st day of the 3 sample got a value of 19.50.
4. Concrete with the addition of palm fiber and charcoal briquettes with variation V.2 on strong testing press day 21 including structural concrete because it achieves the targeted press strength.

4.1.Advice

1. In order not to occur clottation when mixing using mixer or molen it is necessary to note how to insert concrete mixture materials such as cement, charcoal briquettes, fine aggregates, coarse aggregates, water, then input the fibers into molen or mixer (concrete mixing tool).
2. In the nextstudy, to get better results, we recommend that the percentage of palm fiber should be more considered, starting from 1 - 3 % and also tried with more variations and different fiber lengths.
3. At the time of making the test material after mixing using mixer or molen should be more considered so that there are no clumpy palm fibers and at the time of mashing should be carried out according to the procedure so that the printed concrete does not have pores so that the resulting concrete does not damage, in case of damage to the concrete will affect the result of the strong value of the concrete press.

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