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UTILIZATION OF COCONUT FIBER ASH WASTE AS AN ADDED MATERIAL IN MORTAR

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Abstract

Mortar is a combination of materials consisting of fine aggregate (sand), adhesives like clay, lime, and Portland cement, and water with specific proportions. Various factors can affect mortar specifications, including density, age of the mortar, type of bonding material, and aggregate properties. In this study, coconut fiber ash was incorporated as an additive in mortar to enhance its compressive strength. Coconut fiber ash contains silica compounds, which play a vital role in increasing the compressive strength of mortar. The objective of the study was to investigate the impact of adding coconut fiber ash on the compressive strength of mortar, using varying percentages of 0%, 2.5%, 5%, 7.5%, and 10%. The research findings revealed a compressive strength of 253 MPa at a 10% percentage composition after 7 days, and a compressive strength of 253 MPa at a 2.5% percentage composition after 7 days

Keywords*: Mortar, Compressive Stength, Coconut Fiber Ash*

INTRODUCTION

The progress of Indonesia's structural sector is advancing swiftly at present. As the population grows and the demand for various facilities such as offices, roads, bridges, residences, and other amenities increases, the use of mortar as a non-structural material is considered in the realm of development.

Mortar is composed of various materials, including fine aggregate (such as sand), adhesives (such as clay, Portland cement, and lime), and water, with specific components defined by the SNI 03-6825-2002 standard. In ancient times, mortar was initially created using mud and clay since the availability of stone was quite limited. As stated in the National Standardization Guideline No.8 2007, mortar is a blend of sand, cement, and

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water, with varying content proportions, which are mixed using a tool or mixer machine. The properties of mortar as a construction material can be measured, including specific gravity, tensile strength, compressive strength, water absorption, adhesion, and adhesive strength, as mentioned by (Tjokrodimuljo, K 2012).

East Java Island, ranked third in Indonesia, is renowned for its extensive coconut production, as reported by (Muhammad Choirul Anwar, kompas.com, 2021). Consequently, the waste generated from coconut fibers can be utilized in various ways, including its use as a primary material to substitute cement in mortar production. This concept stems from the notion of harnessing the economic value of coconut fiber waste, which is commonly found in households, for the benefit of the community by employing it as a substitute for cement in the production of mortar.

According to (Alexander, 2003), conducted tests on coconut fiber ash (ASK) and obtained the results of the composition of coconut fiber ash compounds containing SiO2 elements of 42.9%; Al 2.26%; Fe 1.16%. The results of this study show that Silica Oxide (SiO2) contained in coconut fiber ash has reactive properties (amorphus) that can cause SiO2 to react chemically with Ca (OH) 2. Silica Oxide (SiO2) acts as an additional material to increase the compressive strength of mortar and reduce cement.

In the previous study (Hendra Taufik, et al, 2013), with a percentage of variation in coconut fiber ash of 0%, 2.5%, 5%, 7.5%, 10%, the compressive strength of mortar increased from normal compressive strength, namely in the percentage variance of 2.5% of the amount of cement. The optimum compressive strength is obtained with a content of 2.5%, which is 17.55 Mpa. In this study using coconut fiber ash as a cement substitution in mortar.

The reason the author took coconut fiber ash as an object of this study is because coconut fibers are very easy to find because they are categorized into waste in traditional markets or households and to utilize coconut fiber waste into materials that can be reused as added material in making mortar.

Therefore, the author became interested in conducting research on the use of coconut fiber ash waste as an added material to mortar with a percentage of the use of coconut fiber ash waste of 0%, 2.5%, 5%, 7.5%, 10% of cement.

RESEARCH METHODS

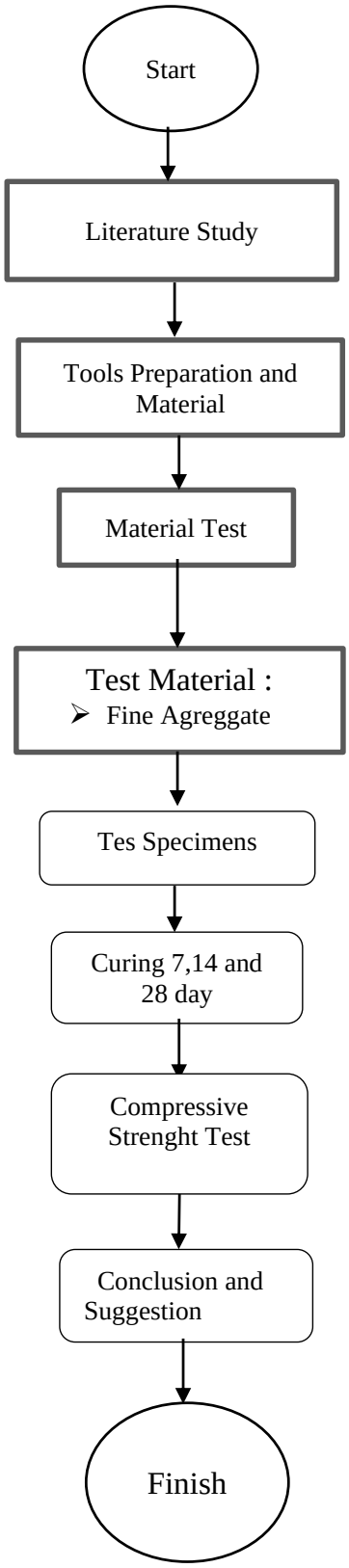

Figure 1. Flow Chart

This research was carried out at the University of August 17, 1945 Surabaya located on Semolowaru Road Number.45, Menur Pumpungan, Sukolilo District, Surabaya. The materials to be used in the study are Portland cement type 2 (PCC), water, and added materials in the form of coconut fiber ash. The following are the specifications of the materials used:

1. Cement

   Portland Composite Cement type 2 (PCC), namely Semen Gresik

2. PAM Water

   Water that does not contain any ingredients or compound elements originating from the Civil Engineering laboratory environment of the University of August 17, 1945 Surabaya.

3. Fine Aggregate (Sand)

   The fine aggregate used is sand originating from the Lumajang Regency.

4. Coconut Fiber Ash

   The coconut fiber ash used is ash obtained from the personal combustion process with a total weight of 70 kg of coconut fibers.

In this study, there were 5 variations in the percentage of the mixture of added coconut fiber ash used. The percentage of coconut fiber ash added material used is 0%, 2.5%, 5%, 7.5% and 10% of the total weight of cement with a total number of test specimens as many as 45 test objects.

Table 1 Test Specimen Planning (Research Data,2023**)**

Name of The Specimen	Coconut Fiber Ash	Compressive Strength		
		7 Day	14 Day	28 Day
ASK-1	0%	3	3	3
ASK-2	2,50%	3	3	3
ASK-3	5%	3	3	3
ASK-4	7,50%	3	3	3
ASK-5	10%	3	3	3
Total		45 Test Specimens		

RESULTS AND DISCUSSION

1. Material Proportions

In this study the variation in the percentage of coconut fiber ash used was 0%, 2.5%, 5%, 7.5% and 10%. The coconut fiber ash used serves as an added material in the material for making mortar. The specimen used is a cube mold measuring 5 x 5 x 5 cm as a compressive strength test on the mortar. The following is a table of the proportions of the material used in making mortar.

Table 2 Material Proposition Design In Making Mortar

Name of Test Specimens	Coconut Fiber Ash (ASK) %	Cement (gram)
ASK 0	0	0
ASK 2,5	2,5	12,5
ASK 5	5	25
ASK 7,5	7,5	37,5
ASK 10	10	50

2. Tes Result Analysis

After the mortar manufacturing process is completed using a predetermined proportional design arrangement, the next step is to carry out the mortar treatment process by immersion in water for 6 days, 13 days, and 27 days, then a compressive strength test is carried out to determine the compressive strength value of the mortar. Here are the results of the compressive strength testing test.

Table 3 Mortar Compressive Strength Result in 7, 14 and 28 Days (Research Data, 2023)

Content of Coconut Fiber Ash (ASK)	Compressive Strength Age 7 Days	Compressive Strength Age 14 Days	Compressive Strength Age 28 Days
ASK 0%	220	220	313
ASK 2,5%	260	233	213
ASK 5%	187	227	187
ASK 7,5%	173	227	173
ASK 10%	253	213	180

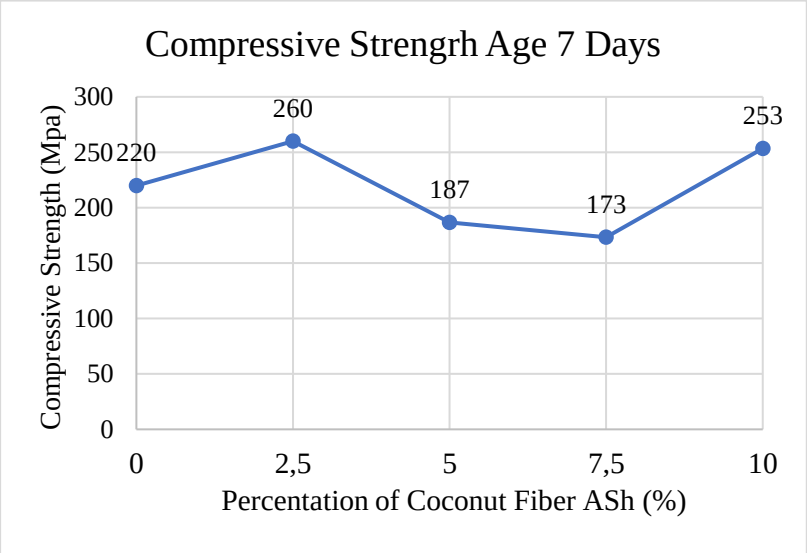

Figure 2 Chart of Compressive Strength Mortar Age 7 Days

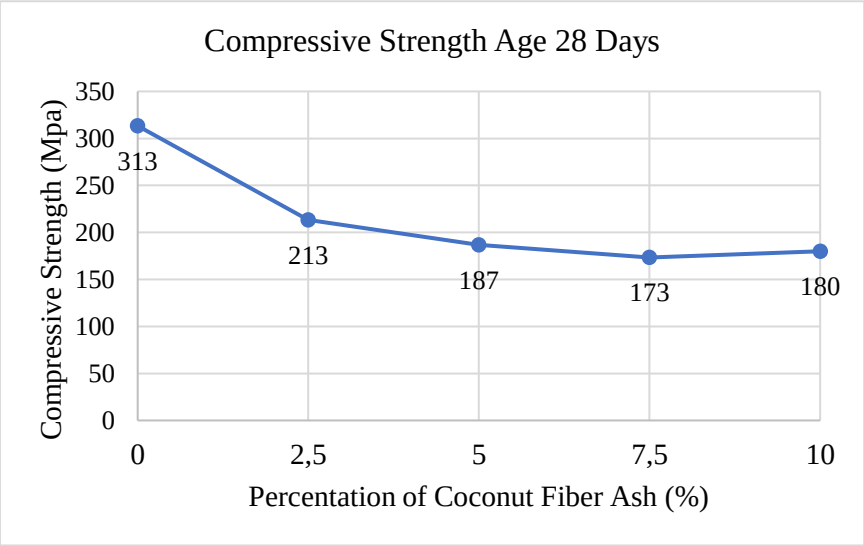

Figure 3 Chart of Compressive Strenght Mortar Age 14 Days

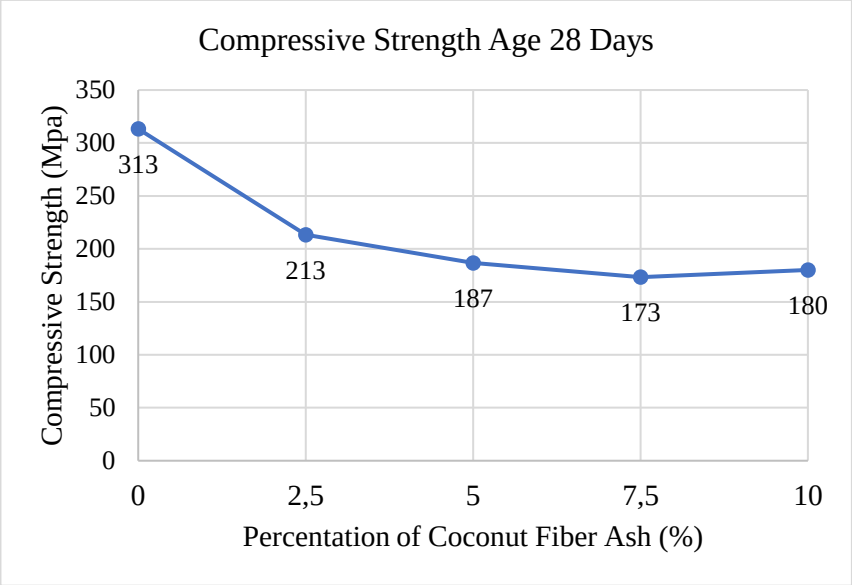

Figure 3 Chart of Compressive Strength Mortar Age 28 Days

Based on the results of the graph above, it can be concluded that at the age of 7 days of soaking mortar (curing) there is an increase in optimum compressive strength in the percentage of coconut fiber ash of 2.5% and 10% with compressive strength of 260 Mpa and 253 Mpa. At percentages of 5% and 7.5% there was a decrease in compressive strength with compressive strength of 187 and 173 Mpa.

At the age of 14 days of curing, there was an increase in compressive strength in the percentage of coconut fiber ash of 2.5%, 5%, and 7.5% with compressive strength of

233 Mpa, 227 Mpa, and 227 Mpa, while in the percentage of coconut fiber ash 10% decreased compressive strength with a compressive strength value of 213 Mpa.

At the age of 28 days of soaking (curing) there was a decrease in compressive strength from the compressive strength of mortar percentage of 0% with a compressive strength value of 313 Mpa. Percentages of 2.5%, 5%, 7.5% and 10% with compressive strength values of 213 Mpa, 187 Mpa, 173 Mpa, 180 Mpa.

CONCLUSION

The compressive strength of mortar with added coconut fiber ash to cement with an age of 7 days with a percentage of 2.5% and 10% increased compressive strength values with values of 260 mpa and 253 mpa respectively. Meanwhile, the percentage of 5% and 7.5% experienced a decrease in the value of compressive strength.

In the compressive strength of 14 days old mortar, there was an optimum increase in the compressive strength value in the percentage of 2.5% coconut fiber ash with a value of 233 MPa and the lowest decrease in the percentage of 10% coconut fiber ash with a value of 213 MPa.In the compressive strength of 28 days old mortar, there was no increase in compressive strength value with the lowest compressive strength decrease value in the percentage of 10% coconut fiber ash with a value of 180 MPa.

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