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Experimental Study of Utilization Corn Weevil Ash Against Concrete Strength

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ABSTRACT

Concrete making that continues to develop rapidly requires quite a lot of materials, this leads to a decrease in natural resources available for concrete making purposes, so that the search for alternative materials as substitutes and added materials from other natural resources or artificial resources. One of the alternative added ingredients to be used is corn weevil. The purpose of this study was to determine the effect of corn weevil ash on compressive strength, bending strength and shear strength of concrete. The method used is an experimental method in quantitative data. The test objects made totaled 36 pieces with 12 cylinders measuring 15 x 30 cm and 24 blocks measuring 15 x 15 x 53 cm. With the results of the compressive strength test, it decreased along with the increase in the percentage of ABJ 0%, 5%, 10% and 15%, namely 24.08 MPa, 23.21 MPa, 20.22 MPa, 14.70 MPa. For strong bending results, there was an increase in the addition of ABJ 0%, 5% and 15%, namely 1.45 MPa, 1.65 MPa, 1.54 MPa, 1.56 MPa. And in the shear strength test, there was a maximum increase in the addition of a 10% ABJ percentage, which was 20.05 kN and a decrease in the addition of ABJ by 5% and 15%, namely 18.75 kN and 18 kN while for normal concrete it was 19.27 kN.

Keywords: *Corn weevil ash, Normal Concrete, Compressive Strength, Bending Strength, Shear Strength*

INTRODUCTION

Development in the field of structure is currently experiencing such rapid progress. Along with the increasing population and the need for facilities that support activities such as offices, roads, bridges, residences and other facilities, concrete is one of the choices for the development of technology and science, people are looking for and conducting research studies on substitutes or added materials that can be used in making concrete which is the main material of construction.

Making concrete that continues to grow rapidly requires quite a lot of materials, this causes a decrease in natural resources available for the purposes of making concrete, so the search for alternative materials as substitutes or added materials from other natural resources or artificial resources. One alternative to be tested and developed as one of the solutions By utilizing corn weevil ash waste as an added material to the percentage of cement in the concrete mixture.

The thought of using corn weevil ash is because corn weevils that are burned will become ash containing SiO2 compounds that have the same adhesion as cement. From the table

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below it can be seen that the ash content of corn weevils has some similarities with portland cement. Therefore, corn weevil ash can be tested as an added material for concrete taken from the percentage of cement.

Table 1: Ash Content of Corn Weevil.

No	Component	Ingredients %
1	SiO2	66,38
2	Al2O3	7,48
3	Fe2O3	4,44
4	Cao	11,57
5	SO3	1,07
6	Na2O	0,41
7	K2O	4,92

Table 2: Portland Cement Content

No	Component	Ingredients %
1	CaO	63
2	SiO2	22
3	Al2O3	6
4	Fe2O3	2,5
5	MgO	2,6
6	K2O	0,6
7	Na2O	0,3
8	SO2	2
9	CO2	-
10	H2O	-

From the table above, it can be seen that the content possessed by corn weevil ash has some similarities with the content possessed by portland cement. This is one of the reasons for using corn weevil ash as an added material from the percentage of cement value for concrete mixture materials.

Figure 1. Corn weevil ash

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A beam that is given a load will deform, and therefore bending moments arise as resistance of the material that makes up the beam to external loads. The stress arising during deformation must not exceed the bending stress permit for the concrete material. The external moment must be held by the material from concrete, and the maximum price that can be achieved before the beam collapses or breaks is equal to the internal holding moment of the beam. If the clearance bending stress is less than the deformation that occurs, a bending failure will occur.

Concrete shear strength is the strength of the components of the upper structural cross-section that serves to increase the rigidity of the structure to withstand lateral forces. In sliding collapses, the collapse that occurs is not marked with advance warning. This warning can usually be cracking or deflection. The cracks in this shear collapse are wider than the bending collapse.

From the above, it can be concluded that corn weevil ash can be used as an added material for concrete mixtures taken from the percentage of cement. This study aims to determine the effect of the addition of corn weevil ash on compressive strength, bending strength and concrete shear.

MATERIALS AND METHODS

This research was conducted at the Civil Engineering Soil Materials and Mechanics Laboratory at Padang State University, Jalan Prof. Dr. Hamka, West Fresh Water., North Padang District, Padang City, West Sumatra.

The research method that will be used in this study is experimental. This research will use test objects in the form of cylinders and beams. Cylindrical specimens measure 15 x 30 cm and beam test specimens 15 x 15 x 30 cm. By using corn weevil ash content of 0%, 5%, 10% and 15%. The following is a test specimen plan.

Table 3. Number of specimens

No	Level ABJ	Compressive strength (cylinder)	Strong Bending (beam)	Shear strength (beam)
1.	0%	3	3	3
2.	5%	3	3	3
3.	10%	3	3	3
4.	15%	3	3	3
number of test specimens		36		

The data obtained is in the form of primary and secondary data. Primary data comes from research results based on applicable SNI. Secondary data based on Padang State University labsheet.

This study will test on:

a. Aggregate Characteristics

Aggregate testing aims to obtain good aggregates in concrete mixtures based on the SNI that has been set.

1). Fine Aggregate

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Table 4. Fine Aggregate Quality Standard

No	Types of testing	Standardization of Testing
1	Sand moisture content test	3,0-5,0 % (SNI 03-1971-2011)
2	Sand Mud Content Test	Max 5% (SNI 03-4142-1996)
3	Sand Specific Gravity Test	1,6-3,2 (SNI 1970:2008)
4	Sand Fill Weight Test	1,4-1,9 (SNI 03-4804-1998)
5	Modulus of Subtlety	2,2-3,1 (SNI 03-1968-1990)
6	Color Organic Content	Standar No 3 (SNI 2816-2014)
7	Absorption	0,2-2 % (SNI 1970-2008)

2) Coarse Aggregate

Table 5. Coarse Aggregate Quality Standard

No	Types of testing	Standardization of Testing
1	Gravel Water Absorbency Test	0,2 – 2 % (SNI 1969:2008)
2	Gravel Sludge Content Test	0,2 – 1 % (SNI 03-4141:2008)
3	Gravel Specific Gravity Test	1,6 – 3,2 (SNI 1969:2008)
4	Gravel Fill Weight Test	1,4 – 1,9 (SNI 03-4804-1998)
5	Pebbles Sieve Analysis	SNI 2417-2008
6	Los Angeles Vessel Violence	SNI 2417-2008

b. Characteristics of Concrete

1). Compressive Strength Test

Compressive strength of concrete based on SNI 1974:2011

2). Flexural Strength Test

Flexural strength based on SNI 4431:2011

3). Shear Strength Test

Concrete shear strength based on SNI 2847:2019

RESULTS AND DISCUSSION

Results

a. Aggregate Test Results

1) fine aggregate

Table 6. Fine Aggregate Test Results

No	Types of testing	Result
1	Fill weight	1,45
2	Specific gravity	2,48
3	Absorption	3,23
4	Water Content	2,74
5	Sludge content	3,80
6	Sift Analysis	% Lolos
	4,75 (No.4)	96,2
	2,36 (No.8)	84,2
	1,18 (No.16)	72
	0,6 (No.30)	45,3
	0,3 (No.50)	26,9
	0,15 (No.100)	3,9
	Pan	0
	Fm	2,71
7	Organic Substances	No 3

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2) Coarse Aggregate

Table 7. Coarse Aggregate Test Results

No	Types of testing	Results
1	Fill weight	1,45
2	Specific gravity	2,65
3	Absorption	1,92
4	Water Content	2,18
5	Sludge content	0,8
6	Sift Analysis	% Lolos
	4,75 (No.4)	96,2
	25 (I inc)	
	19,1 (3/4 Inc)	
	12,5 (1/2 Inc)	
	9,5 (3,8 Inc)	
	4,75 (No.4)	
	Pan	
	Wear	20,3

b. Concrete Testing Results

1) Compressive Strength

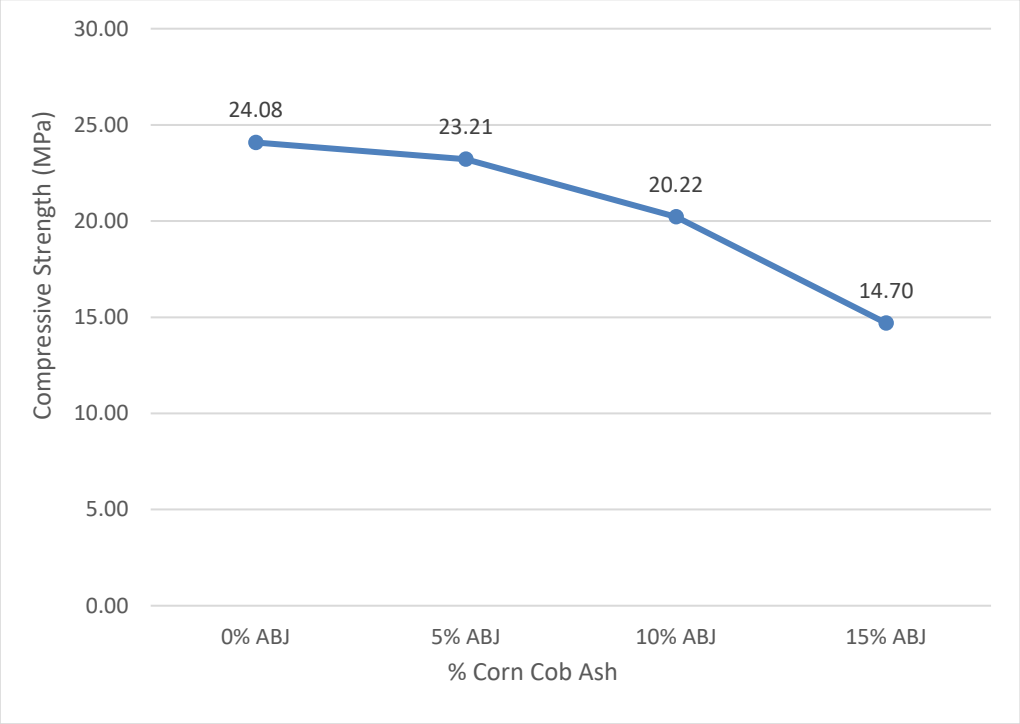

Figure 2. Compressive Strength Test Results Graph

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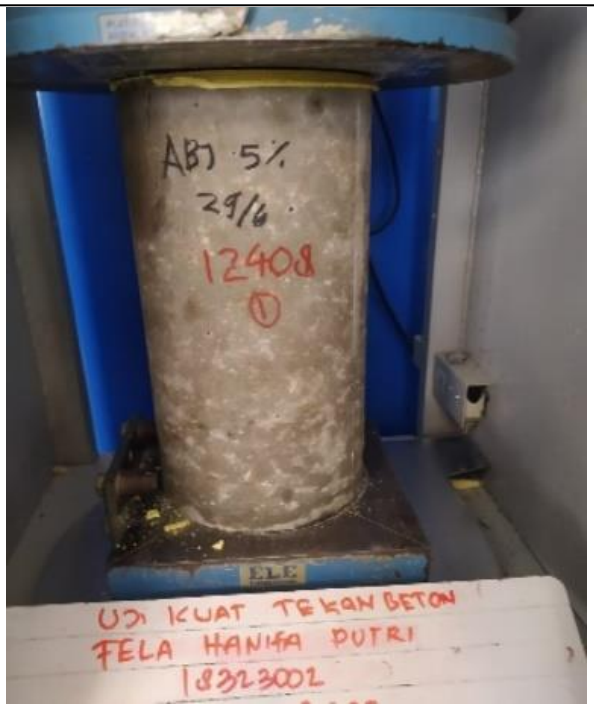

Figure 3. Compressive strength testing

2) Flexural strength test results

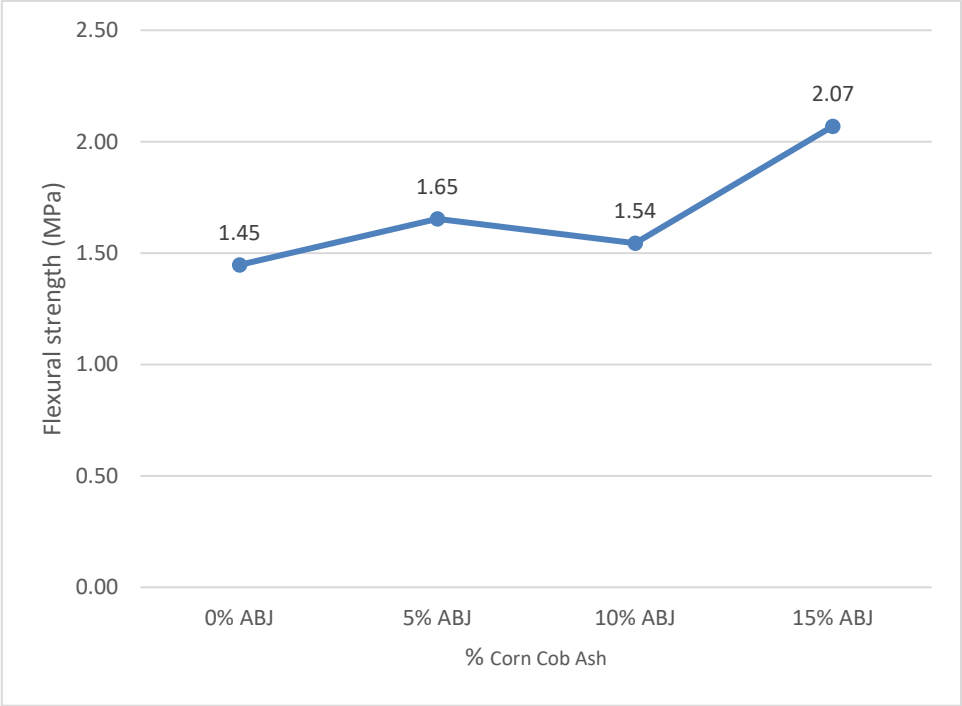

Figure 4. Flexural strength test results graph

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Figure 5. Flexural strength testing

3) Shear strength

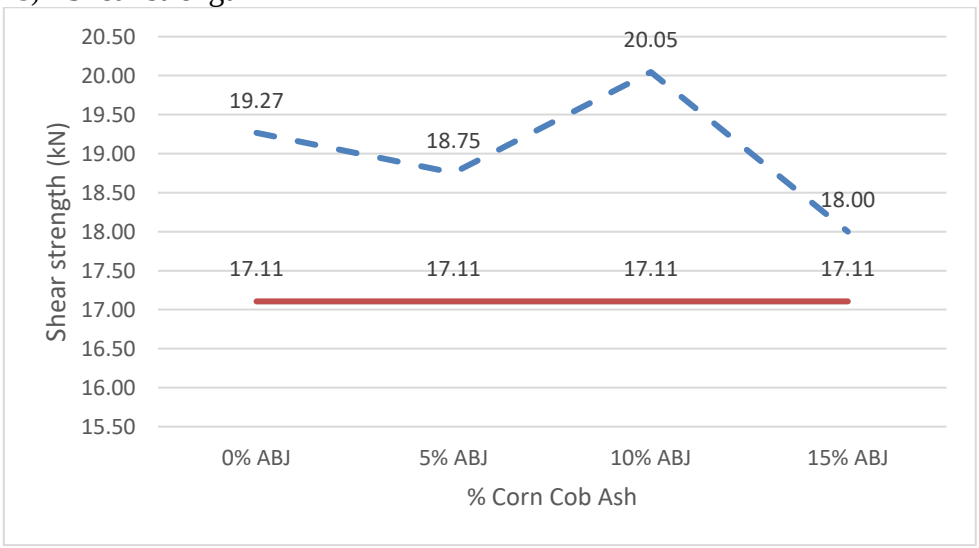

Figure 6. Shear Strength Test Results Graph

Figure 7. Shear Strength Testing

The fine aggregate that has been tested has met the quality requirements set by SNI. Then this fine aggregate can be used for concrete making materials. The coarse aggregate that has been tested has met the quality requirements set by SNI. Then this fine aggregate can be used for concrete making materials.

From the results of compressive strength testing, it was found that the compressive strength of concrete fell with the addition of corn weevil ash. However, at percentages of 5% and 10% are still at the plan's compressive strength of 20 MPa.

In the flexural strength test, the bending strength rose with the addition of corn weevil ash of 5%, 10% and 15%. The maximum increase occurred at a percentage of ABJ of 5%. The addition of ABJ in this shear strength test is not affected by the addition of ABJ or faults.

CONCLUSION

Base on the result of research conducted. The following conclusion were obtained:

1. The addition of ABJ decreases compressive strength and shear strength. While the addition of ABJ to the bending strength has increased.The alternative shear wall placement in model A, model B, and model C considered less effective, because shear walls located in the middle of the building can disrupt the function of the rooms in the building.
2. Compressive strength testing of concrete decreased strength at the addition of ABJ 5%, 10% and 15%. In normal concrete, the compressive strength value is 24.08 Mpa. Meanwhile, the addition of ABJ experienced a significant decrease of 23.21 Mpa, 20.22 Mpa, and 14.7 Mpa. However, the value of adding ABJ is still above the compressive strength of the plan, which is 20 Mpa.
3. Testing the bending strength of concrete has increased in the addition of ABJ 5%, 10% and 15%. For normal concrete get a compressive strength value of 1.45 Mpa. The maximum increase occurs at a percentage of 5%. The value of bending strength is not only influenced by the addition of ABJ but also influenced by the faults that occur.
4. Shear strength testing in theory has no effect on ABJ and faulting occurs

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