Effect of Different Curing Methods in Flexural Strength of Concrete

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Abstract: - Concrete curing is very important for the flexural strength of concrete. Flexural strength is the ability of the concrete to resist bending or cracking under load. During the curing process, the concrete gains strength as the water in the mix reacts with the cement to form hardened cement paste. This process is known as hydration. Introducing the use of rice husk and rice straw as a curing method may offer cost-effective advantages. Rice straw and rice husk are typically inexpensive and widely available in rice-producing regions, which can make it a cost-effective alternative to conventional curing method. This can be particularly beneficial for construction projects with budget constraints, where cost-effective solutions are important. The researchers produced a total of twenty-four (24) concrete beam samples, and three flexural strength tests were done on each curing method and curing period. Four curing methods were used, which are water curing, curing compound, and the introduced curing methods, rice husk, and rice straw. The curing periods were 7 and 14 days. After conducting the test, it shows that water curing has the highest flexural strength in both 7 and 14 days and it is the most effective and efficient curing method among the 4 curing method that have been used. Rice husk and rice straw passed the flexural strength test. These are effective and can be used as a curing method for curing a concrete.

Key Words— ***Alternative Curing Method, Concrete Curing, Flexural Strength Test, Rice Husk, Rice Straw.***

I. INTRODUCTION

Concrete is one of the most widely used building materials when it comes to the construction industry. It is a composite material that consists of coarse aggregates (gravel) and fine aggregates (sand) that are bonded together by cement or lime, and water. Concrete is utilized in all sorts of infrastructures, from constructing roads, bridges, and dams, to residential homes, multi-storey buildings, and commercial buildings. It is used in developing foundations, columns, beams, slabs, and different load-bearing components. Concrete is considered to be a strong and durable material. However, its strength and quality are dependent on the hardened state of the concrete. This process is known as curing.

Manuscript revised May 20, 2023; accepted May 21, 2023. Date of publication May 23, 2023.

This paper available online at www.ijprse.com

ISSN (Online): 2582-7898; SJIF: 5.59

Curing helps to retain enough moisture and control the temperature inside the concrete. This process helps the concrete to maximize its strength and longevity. There are several ways when it comes to curing, such as water curing, covering with wet burlap, and applying membrane- forming curing compounds. Each method gives different results when it comes to strength and quality, but it all reached the required strength for concrete. When it comes to choosing the best option, it always depends on various factors, such as the availability of water, curing materials, labor constraints, and weather conditions. In this study, rice husks and rice straws, which are both agricultural wastes, are used as a method for curing concrete. These new methods are being compared to water curing and curing compounds. This study also determines their effect on the flexural strength of concrete, and if the new methods can be effective curing methods.

II. STATEMENT OF THE PROBLEM

This study aims to introduce rice husk and rice straw as a new process of curing a concrete. Utilization of rice husk and rice straw can lessen the burning in an open field and will have a great impact to the environment. There are several curing

methods available to cure a concrete such as water curing, curing compound, and abaca sacks. But choosing curing methods depends on various factors, such as the cost and availability of the material.

III. OBJECTIVES

3.1 General Objectives

The main objective of this research is to determine the effect of the different curing methods such as water curing (submerged), curing compound, and introducing the use of rice husk and rice straw as new curing methods, on the flexural strength of concrete to see which method is most effective when it comes to durability. Concrete curing and flexural strength tests (mid-point loading) are to be done.

3.2 Specific Objectives

- What is the effect of each curing method on the sample beam?
- What is the strength of all sample beams by flexural strength test?
- How effective is the rice straw and rice husk as curing methods?
- Which among the rice husk and rice straw as curing methods is the most effective based on the results?

IV. METHODOLOGY

4.1 Research Design

This study makes use of a quantitative and experimental approach in which data will be collected for the objectives of the study. The principal purpose of the researchers is to identify theeffect of different curing methods on the flexural strength of concrete. The choice of experimentaldesign was motivated by the following factors, first, it helps a researcher gather the necessary data for making better research decisions and determining the facts of a research study. Secondly, itisolates that data to provide the precise results needed.

4.2 Research Setting

The researchers had to provide and cure the sample concrete beams using different curing methods such as water curing, compound curing, rice husk, and rice straw that was conducted at Rizal, Nueva Ecija.

The materials used were collected from different places in Nueva Ecija. The water, cement, gravel, and sand, as well as the rice husk and rice straw that were used as an alternative curing method were collected from Rizal, Nueva Ecija. The improvised slump cone that have been used to measure the consistency of fresh concrete before it sets were made also from Rizal, Nueva Ecija. The molds that have been used for the concrete beam were made from Aliaga,Nueva Ecija. The curing compound as one of the different curing methods in the study was collected from Zaragoza, Nueva Ecija.

After curing the concrete beam with different curing methods, a flexural strength test was conducted at the Civil Engineering Laboratory, Nueva Ecija University of Science and Technology, Sumacab Campus.

4.3 Data Gathering Procedures

The study utilized an experimental research method in gathering the data. The production of concrete beam specimens, slump testing, concrete curing, and flexural strength test are to be done. The researchers conducted three tests in each curing period to gain the best results. The test observed the proper procedure on how to conduct with respect to ASTM C293 (mid-pointloading).

a. Slump Test
b. Production of Concrete Beam Specimen
c. Concrete Curing
d. Flexural Strength Test

4.4 Data Gathering Instrument

The data was collected from the results of the Flexural Strength Test conducted using the Universal Testing Machine (UTM).

Flexural Strength Formula (Mid-point)

$$F = \frac{3PL}{2bd^2}$$

Where,

F = flexural strength

P = load in KN

L = length

b = width

d = depth

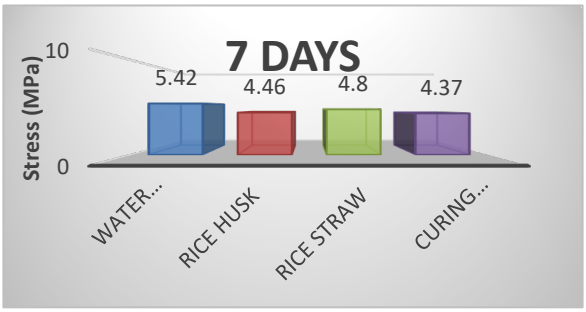
Table 7.2: 14-Day Concrete Beam Mix Design Strength Projection (Mid-Point Loading)

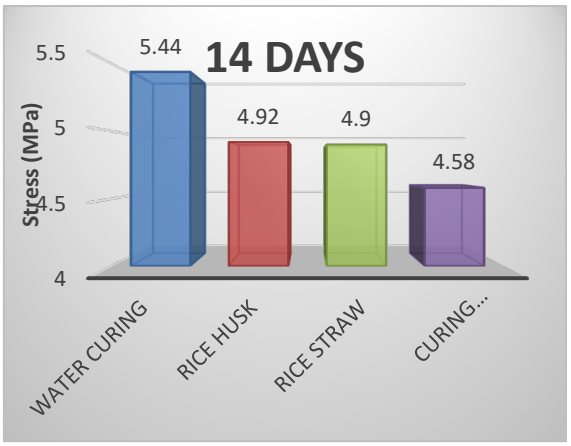
AGE DAY	PERCENT (%)	READING (kN)	STRENGTH (Psi)	STRENGTH (Mpa)
1	17.64	5.18	97	0.67
2	42.36	12.44	233	1.61
3	55.82	16.39	307	2.12
4	64.73	19.00	356	2.45
5	70.91	20.82	390	2.69
6	77.09	22.63	424	2.92
7	81.82	24.02	450	3.10
8	85.27	25.03	469	3.23
9	88.81	26.10	489	3.37
10	91.82	26.96	505	3.48
11	94.18	27.65	518	3.57
12	97.09	28.50	534	3.68
13	99.45	29.20	547	3.77
14	100.00	29.36	550	3.79
15	102.00	29.95	561	3.87

Flexural strength must not be less than 4.5MPa when tested by the mid-point method at fourteen (14) days in accordance with AASHTO T177

V. Results And Discussion

Flexural strength is an important property of concrete, as it measures the ability of the material to resist bending or cracking under a load. The flexural strength of concrete is an important property that must be considered in the design and construction of many types of structures. The flexural strength of the concrete must not be less than 4.5 MPa when tested by the mid-point method at 14 days in accordance with AASHTO T 177. Based on the results, water curing has the highest flexural strength on both 7 and 14 days after conducting and testing of the 24 concrete beams samples using different curing methods. The average flexural strength in water is 5.42 MPa and 5.44 MPa on 7 and 14 days, respectively. Using the curing compound as a curing method on the concrete beams sample also passed the flexural strength test with an average of 4.46 MPa on 7 days while 4.58 MPa on 14 days. The results from the above discussion shows that the rice husk and rice straw are effective and can be used as a new curing method in curing a concrete. The average flexural strength in rice husk is 4.46 MPa on 7 days and 4.92 MPa on 14 days. On the other hand, the average flexural strength in rice straw s 4.80 MPa and 4.90 MPa on 7 and 14 days, respectively.





VI. Conclusion

Curing is of utmost importance for the flexural strength of concrete as it significantly affects the overall durability and performance of the concrete in terms of its ability to withstand bending stresses without cracking or failing. It is a critical process in concrete construction that involves providing best conditions for freshly placed concrete to properly hydrate and gain strength. It involves maintaining the right temperature, humidity, and moisture content of the concrete during the initial stages of its curing process, typically for a period of 7 to 14 days for the concretes flexural strength.

A total of 24 beams was tested by the researchers. Different curing method was done such as water curing, curing compound, and introducing the use of rice husk and rice straw as new curing method. The result shows that there is no significant difference between the four curing method used in concrete.

It shows that rice husk and rice straw is as effective as water curing and curing compound which can use as a process of curing concrete nowadays.

There are several potential benefits of using rice husk and rice as a curing method in construction applications. First and foremost, it is a sustainable and environmentally friendly option, as it utilizes a byproduct that would otherwise be considered as waste. Additionally, rice husk and rice straw curing methods have shown promising results in improving the durability, strength, and resistance to cracking of concrete, which can lead to longer service life and reduced maintenance costs for concrete structures. Furthermore, rice husk and rice straw curing methods are often cost-effective compared to conventional curing compounds, making them an attractive option for construction projects with budget constraints.

On the other hand, water curing is a widely used method for curing concrete, and it can have a significant impact on the flexural strength of a concrete beam. Based on the results, water curing has the highest stress reached after the testing. But it shows that rice husk and rice straw is perfect as an alternative to the curing compound since curing compound is not convenient or available in some places in the Philippines. Moreover, rice husk and rice straw has the highest flexural strength compared to curing compound.

In conclusion, the utilization of rice husk and rice straw as a curing method for concrete is an interesting and innovative approach that shows potential for improving the performance and sustainability of concrete structures.

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