A REVIEW ON THE UTILIZATION OF RICE HUSK ASH AS ADMIXTURE IN CONCRETE

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The Thesis is Submitted to the Department of Civil Engineering, Daffodil International University in partial fulfillment of the requirements for the award of Degree of **Bachelor of Science in Civil Engineering**

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Certification

This is to confirm that the following students worked on the project and thesis titled " **A REVIEW ON THE UTILIZATION OF RICE HUSK ASH AS ADMIXTURE IN CONCRETE**" under my close supervision andguidance. To partially meet the criteria for the degree of Bachelor of Science in Civil Engineering, they conducted a variety of experimental work in the laboratories of the Department of Civil Engineering within the Faculty of Engineering at Daffodil International University. The work was presented on July 10, 2024.

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DEDICATION

Dedicated to OUR PARENTS

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ASTM	American Society of Testing Materials
PCC	Portland Composite Cement
NC	Normal Concrete
CS	Compressive Strength
RHA	Rice Husk Ash

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ABSTRACT

To evaluate the usage of rice husk ash as an additive in a typical setting, the effects of adding RHA to concrete grades 20 and 30 at 0%, 5%, 10%, and 15%, respectively, are determined. The recovered husk was sun dried, screened, and burned in an incinerator set at 400 degrees Celsius. After cooling and passing through a 425μm screen, the ash was added as an additive during mixing. Both grades of concrete were mixed, and both fresh and hardened concrete's characteristics were evaluated. The CS of a cylinder of RHA concrete samples that were curing in water was measured at 7, 14, and 28 days, respectively. The findings demonstrated that, for both concrete classes, the slump of RHA concrete increases as the percentage of RHA added increases. The addition of 5% and 10% RHA, respectively, increases the cs of samples of both concrete classes cured in water; however, the strength gain was greater with the addition of 5% RHA. 15% addition of RHA lower than others two percent of addition of rice husk ash.

CHAPTER 1

INTRODUCTION

1.1 General

For a long time, one of the main components utilized in the construction of buildings and other civil engineering projects was concrete. Cement, fine, coarse, and water aggregate combinations are combined to create concrete, a composite material. When needed, additives can be added to the concrete to change specific characteristics while it's still soft or firm. When the material is mixed well and correctly batched, it initiates the hydration process and solidifies into a concrete mass that can withstand compressive forces. Because of its elasticity, fresh concrete may be shaped into a wide range of sizes and shapes. The need for building never goes away in most African nations, including developing nations like Nigeria. As a result, there is a strong demand for construction supplies such as admixtures and ordinary Portland cement (OPC). These items require capital-intensive plants and specialized knowledge to produce. OPC and traditional admixtures are frequently too expensive for the average person to afford.

1.2 Objective of The Study

The objective of this study is to review the feasibility of utilizing rice husk ash by studying properties like Slump Retention, Water Absorption, and Compressive Strength.

1.3 Methodology of Study

1.3.1 General

The most important characteristics and terminology of the concrete are its compressive strengths. Concrete's properties are described in detail by these tests. The makeup and characteristics of the component materials, the methods for testing and curing, and the preparation procedures can all impact compressive strengths.

1.3.2 Follow the Rules

1. Topic Selection
2. Search Strategy
3. Selection Criteria
4. Literature Organization
5. Critical Analysis
6. Synthesis of Findings
7. Discussion and Conclusion
8. Writing the Review
9. Citation and Referencing
10. Revision and Editing

1.4 Thesis Outline

There are five chapters, an appendix, and a list of references in this review paper.

Chapter 1 (Introduction)

Concrete and its composition, compressive strength, goal, and study circumstances are discussed in this chapter.

Chapter 2 (Literature Review)

Included are earlier studies, journal articles, thesis books, and research papers on its impact on concrete qualities.

Chapter 3 (Methodology)

This chapter covers the various kinds of laboratory testing, standards, methods, slump tests, water absorption, curing conditions, and compressive strength.

Chapter 4 (Result and Discussion)

This chapter describes the test findings from the compilation of different types of journal articles and thesis papers.

Chapter 5 (Conclusions and Recommendations)

Some recommendations for additional research are included in this chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter utilizes some of the available prior research, compresses the concrete, and evaluates the effect of adding rice husk as an admixture on the mechanical characteristics of the concrete.

2.2 Admixture Description

In preparing the cylinder, additives, usually adding rice husk become moist while being mixed. Rice Husk Ash is a valuable byproduct of milling rice that offers nutritional benefits and a variety of uses in various industries.

A summary of the main qualities of rice husk may be found below.

1. Make constructing with concrete less expensive.
2. The goal is to acquire particular tangible traits successfully.
3. Mixing, moving, and placing patients in challenging situations is the aim of conventional high-quality care.
4. Make an effort to separate the concrete pouring activity's limbs.

2.3 Literature Review

One type of highly reactive pozzolan is rice husk ash (RHA). The financial, technical characteristics, and environmental benefits of using locally accessible and less-priced RHA as a mineral additive in concrete are substantial. The effect of RHA blending on the workability, strength, and durability of high-performance fine-grained concrete (HPFGC) is examined experimentally in this research. The results show that RHA added to HPFGC significantly improved the material's compressive strength, splitting tensile strength, and resistance to chloride penetration. Notably, the ratio of the splitting tensile strength to the compressive strength of HPFGC was significantly lower than that of ordinary concrete, especially for the concrete that included 20%. **(Sang, 2014**)

Though it contains less amorphous silica than RHA made by controlled burning, some researchers recommend adding residual rice-husk ash (RHA) that has been finely divided into cement as a mineral addition. With high and low amounts of amorphous silica, respectively, and varying particle size distributions, the pozzolanic activity of residual RHA A and residual RHA B is examined in this article. To characterize the characteristics techniques such as scanning electron microscopy (SEM), magic-angle spinning (MAS) nuclear magnetic resonance (NMR) spectroscopy, and a quick analytical approach were employed. **(Rêgo, 2015)**

The goal of this study was to determine how mesoporous amorphous rice husk ash (RHA) affected the internal relative humidity (RH), autogenous shrinkage, portlandite content, and compressive strength of ultra-high-performance concretes (UHPCs) with and without ground granulated blast-furnace slag (GGBS) under various conditions. The outcomes were contrasted with UHPCs that contained SF (silica fume). RHA's mesoporous structure allows it to absorb a certain amount of aqueous phase, which lowers the free water content and provides water for subsequent cementitious material hydrations. As a result, samples blended with RHA have increased compressive strength. Compared to SF, the highly water-absorbing RHA significantly reduces autogenous shrinkage of UHPCs by delaying and slowing down the decline in internal RH (self-desiccation). **(Rößler, 2014)**

The use of additional cementitious materials could reduce CO2 emissions, which are mostly caused by the cement industry. When generated correctly and under controlled conditions, rice husk ash (RHA), one of the additional cementitious materials, has high pozzolanic qualities. Four different concrete mixtures were examined in this study to determine how RHA—produced under controlled conditions—affects the concrete's performance attributes. RHA was applied in addition to regular Portland cement, increasing its percentage from 10% to 30%. Based on the findings, it was discovered that adding RHA up to 20% in partial substitution of regular Portland cement enhanced the concrete's compressive strength in comparison to reference mixtures. **(Muthadhi, 2013)**

A physical test of the recently made mixture was also performed. Hollow concrete blocks measuring 150 mm by 450 mm were cast, cured, and crushed at replacement levels of 0, 10, 20, 30, 40, and 50% throughout 1, 3, 7, 14, 21, and 28 days. The majority of the commercial concrete blocks in Minna town, according to test results, are subpar. The OPC/RHA concrete blocks' compressive strength rises with curing age and falls with increasing RHA content percentage. **(Oyetola, 2006)**

Research has been done on the impact of partially substituting cement with SF or RHA. Gravel served as the standard normal aggregate, whereas ilmenite and baryte were employed as heavy aggregates. The mechanical, shielding, and physical characteristics of several large weight concrete varieties were investigated. An investigation was conducted into the concrete's durability. The examination was broadened to include the influence of absorbed gamma radiation, infrared and thermal studies, and the microstructure of the concrete types under study. **(Sakr, 2006)**

Extensive research has been conducted in recent decades on the use of residue in civil construction, particularly as an additive to concrete, since it may enhance the properties of concrete in multiple ways while also reducing environmental pollution problems. Brazil is the eighth-largest producer of rice in the world, with an estimated 500 million tons harvested annually. Ten by twenty-centimeter samples were tested with mass replacements of cement in the amounts of 5% and 10% RHA. Evaluations were done on characteristics such as modulus of elasticity, water absorption, and simple compressive strength. **(Tashima, 2004)**

The primary goal was to determine the effects of highly active rice husk ash (RHA) produced in an industrial furnace on specific concrete properties. The strength, pore volume, pore distribution, and Ca $(OH)_2$ content of the concrete were investigated using thermogravimetric analysis, a mercury instrument porosimeter, and JIS A 1108 (Method of test for compressive strength of concrete), in that order. The results show that: the concrete's compressive strength increases noticeably when RHA is substituted for cement; the average pore radius of the concrete increases while the amount of smaller pores decreases significantly, especially for the portion of the pores larger than 20 nm in radius; and the more RHA is substituted, the less Ca $(OH)_2$ in the concrete**. (Qing-ge, 2004)**

At different ages up to 180 days, the compressive strength is higher than the concrete. The flexural and cracking tensile strengths, drying shrinkage, and moduli of elasticity were comparable between the control concrete and the concrete treated with silica fume or RHA. The RHA concrete demonstrated exceptional resistance to the penetration of chloride ions, as demonstrated by the charge communicated in coulombs being less than 1000 on days 28 and 91. Furthermore, the RHA concrete exhibited remarkable performance in freezing and thawing conditions. Its resistance to deicing salt scaling was only marginally better than that of the silica fume concrete and on par with that of the control concrete. **(Zhang, 1996)**

It was demonstrated that the cementing property was a pozzolanic reaction between the two components in the absence of Portland cement in the combination. The properties of cementitious materials such as calcium carbide residue and rice husk ash were researched, including paste setting times, mortar flow, and compressive strength. The results show that the new cementing pastes need longer setting times than Portland cement paste. When calcium carbide residue and rice husk ash are employed in a weight ratio of 50:50, the maximum compressive strength of the mortar is reached. **(Jaturapitakkul, 2003)**

Rise husk ash and leftovers from industrial and agricultural wastes have been added to concretes to capitalize on Senegalese native materials (sands from dunes, residual fines from the crushing process, and agricultural and industry wastes). When unground ash and especially ground ash—is added to concrete blocks, their mechanical resistance increases, indicating a performance boost above traditional mortar blocks. Furthermore, it is less expensive to produce lightweight, insulating concrete when unground rice husk ash is used. The high strengths attained are explained by the ash. **(Cisse, 2000)**

The product retains its rapidly lost its water content. It starts to change into crystalline CaSiO3 above 780°C. The development of more C-S-H gel and less portlandite in concrete as a result of the reaction between RHA and the Ca2+, OH- ions, or Ca(OH)2 in hydrating cement may be one of the primary causes of the improvement in concrete qualities upon the addition of RHA. **(K Sawayama, 1999)**

The need for building never goes away in most African nations, including developing nations like Nigeria. As a result, there is a strong demand for construction supplies such as admixtures and ordinary Portland cement (OPC). These items require capital-intensive plants and specialized knowledge to investigate the viability of blending pozzolanic materials that are readily available locally in place of some or all of the more costly conventional admixtures in mortar and concrete. **(Aboshio, 2009)**

Ash from various industrial and agricultural wastes is among the many siliceous or aluminous elements that can be pozzolanic. Rice husk has been shown to have the most potential of all agricultural wastes because it is easily obtainable and burns to produce a sizable amount of ash that is around 90% silica. Five tonnes of rice paddy yields about one tonne of husk, and it's predicted that 120 million tonnes of husk might be accessible annually for the manufacturing of pozzolana worldwide. **(Nagrale, 2012)**

The invention of self-compacting concrete occurred in Japan during the 1980s labor shortage, mostly as a result of Okamura's efforts. A committee was established to investigate the characteristics of self-compacting concrete, including a basic study on the workability of concrete conducted by Ozawa et al. at the University of Tokyo [1]. 1988 saw the completion of the first workable variant, Because of its great fluidity, this concrete could flow easily, solidify under its weight, and be placed in challenging conditions, such as in a section with crowded reinforcing, for self-compacting concrete. **(Olowofoyeku, 2019)**

With an increase in RHA addition and an increase in acidic solution concentration. The most aggressive media was a solution of sulfuric acid, which was followed by solutions of nitric acid and hydrochloric acid. Cement, fine aggregates, coarse aggregates, and water are combined to create concrete, a composite material. When necessary, additives can be added to the concrete to change its fresh or hardened state-specific qualities. **(Zhang, 1996)**

CHAPTER 3

METHODOLOGY

3.1 General

The raw materials, sample preparation, and execution of the inquiry's conventional experimental tests are all covered in this chapter.

3.2 Materials

All kinds of materials are collected from outside the local area, such as Cement, Rice Husk Ash, Coarse aggregate, and Fine aggregate.

3.2.1 Cement

The cement used in this research is ordinary Portland cement. The nearby cement suppliers provided the cement.

3.2.2 Fine aggregate

Natural sand and Sylhet sand sourced from nearby suppliers were used as the fine aggregate.

3.2.3 Coarse aggregate

Crushed granite was acquired from local outside suppliers to be used as coarse aggregate in this project.

3.2.4 Water

Portable tap water was used for making the concrete.

3.2.5 Rice Husk Ash

Rice husk was collected from a local mill. It was sun-dried, screened, and then burnt in an incinerator at 400°C. The resulting ash was cooled in free air circulation and sieved through a 425 μm sieve. The ash that passed through the sieve was used for the research.

3.2.6 Slump Retention

The slump retention method refers to concrete mixing processes that lengthen the period during which the concrete maintains its workable consistency, often known as a slump.

Some common methods to retain slump include:

- After giving the mold inside a thorough cleaning, set it on a horizontal, smooth, firm, and non-absorbent surface, like a metal plate.
- Assume that a mix has already been prepared for the test and consider a W/C ratio of 0.5 to 0.6 for the design mix. Accurately weigh the amount of water, aggregate, sand, and cement. Stir well. For the test, use this recently made concrete.
- Pour concrete into the mold to a depth of approximately 1/4 of its height. Hold the mold firmly in place while filling.
- Using the tamping rod's round end, tamp the layer in 25 strokes, distributing the strokes evenly across the cross-section.
- Continue to fill the mold in three levels, filling each one to a quarter of its height and tamping each layer as before. Once the topmost layer has been rodded, level the top of the mold by striking the concrete with a trowel or tamping bar.
- Carefully lift the mold vertically and extract it.
- After subsidence, measure the concrete specimen's height of 30
- The subsidence, or the difference in the initial height and height up to the highest point of the subsided concrete in millimeters, is known as the slump of concrete.

3.2.7 Water Absorption

The water absorption method refers to a technique used to determine the porosity and permeability of concrete or other porous materials.

Here's how the water absorption method typically works:

- Cleanup, drying, and sieving are done to aggregates. Fine particles are eliminated by doing this.

- The ready-made samples are submerged in water. This is done to make sure the aggregates are completely saturated and to fill in any gaps.
- Following saturation, the aggregate surface is typically dried with a cloth. The purpose of it is to get rid of extra water.
- The aggregate is weighed in three different conditions, dry (after oven drying), saturated surface dry (SSD), and wet.

3.2.9 Compressive Strength of Concrete

The compressive strength of concrete is a critical parameter that indicates its ability to withstand compressive loads. It is typically measured by crushing cylindrical concrete specimens in a compression-testing machine.

To determine the compressive strength of concrete:

- After the allotted curing period, remove the specimen from the water and wipe off any excess moisture.
- To the closest 0.2 mm, measure the specimen's dimensions.
- The testing machine's bearing surface should be cleaned.
- Insert the specimen into the machine such that the cube's opposing sides will experience the load.
- Place the specimen in the center of the machine's base plate.
- Turn the movable part by hand slowly until it makes contact with the specimen's top surface.
- Apply the load until the cylinder breaks down.
- Take note of the maximum load and any peculiarities in the failure type.

Note: For every age group chosen, a minimum of three specimens should be tested. Any specimen whose strength deviates more than 15% from the average strength ought to have its results disregarded.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Slump Test (K Sawayama, 1999)

A test to measure the consistency of fresh concrete by assessing how much it slumps, or deforms, from its original shape after being placed in a conical mold and lifted off.

20-grade concrete The notional ratio of M20 grade concrete is around 1:1.5:3, with a water-to-cement ratio maintained between 0.4 and 0.6. It is made up of a blend of 1 part cement, 1.5 parts fine aggregates, and 3 parts coarse aggregates.

30-grade concrete The percentage of components needed to produce a specific strength in concrete is known as the M30 concrete mix ratio. The ratio is 1:0.75:1.5, meaning that 1 part cement, 0.75 parts fine aggregate, and 1.5 parts coarse aggregate to make 1 cubic meter of concrete.

Table 4.1 Summary of Slump Test

Concrete grade	ADDITION OF RHA (%)	SLUMP(mm)
20	0	17
	5	20
	10	22
	15	24
30	0	12
	5	15
	10	17
	15	19

The standard range of slump tests are (0-25) mm is very low, (25-50) mm is low, (50-100) mm is medium, and (100-175) mm is a high degree of workability. Here all of the slump test results are below 25 mm. So the degree of workability of concrete is very low.

4.2 Summary of Water Absorption of Grades 20 and 30 RHA Concrete Cured for 28 Days (Muthadhi, 2013)

The percentage increase in weight of a material when it is immersed in water for a particular period is usually represented as a percentage of the dry weight.

Table 4.2 Water absorption test results

Concrete grade	ADDITION OF RHA (%)	Water Absorption %
20	0	2.67
	5	2.35
	10	1.89
	15	1.73
30	0	2.10
	5	1.99
	10	1.71
	15	1.58

The water absorption value should not exceed 3%. 2% in critical conditions such as highly aggressive chloride or freeze–thaw exposure. The drying shrinkage test is limited to aggregates with water absorption <3.5%. Here all of the water absorption results are below 3%.

4.3 Compressive Strength Analysis (Aboshio, 2009)

4.3.1 Compressive Strength of Normal Concrete (Aboshio, 2009)

Here no rice husk ash is used as admixture.

Table 4.3 CS of concrete without adding admixture

Curing Duration	Concrete Grade	Average Compressive Strength (MPa)
7	20	19
14	20	23
28	20	27

The height average of Compressive strength of normal concrete is 27 MPa and the lowest is 19 MPa. We got the height average value at 28 days of curing.

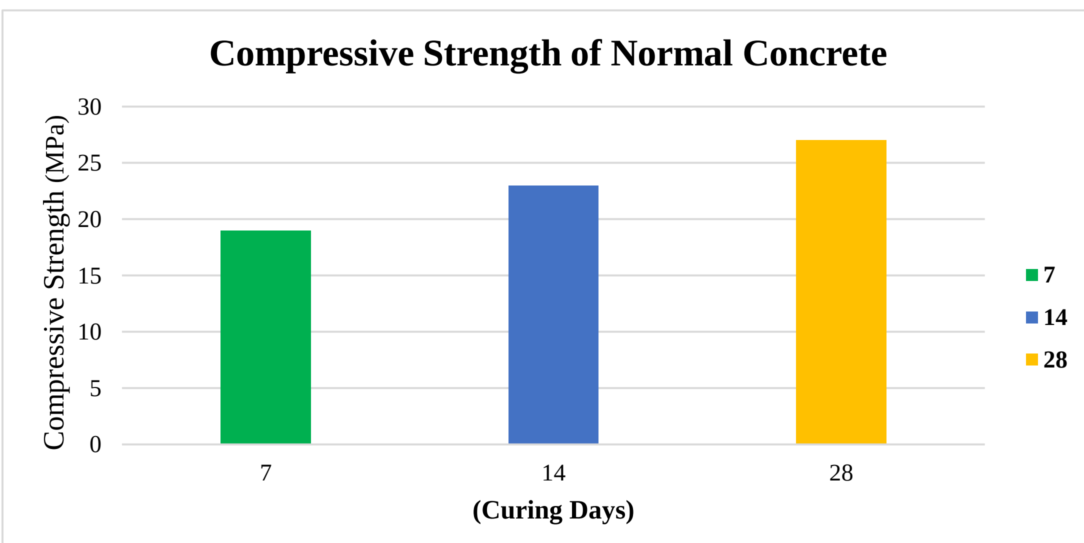

Figure 4.1 Compressive Strength of Normal Concrete

4.3.2 **CS of Concrete with 5% admixture** (Aboshio, 2009)

Here 5% rice husk ash is used as admixture.

Table 4.4 CS of Concrete with 5% admixture

Curing Duration date	Concrete Grade	Average Compressive Strength (MPa)
7	20	21
14	20	27
28	20	30

The height average of Compressive Strength of Concrete with 5% admixture is 30 MPa and the lowest is 19 MPa. We got the height average value at 28 days of curing.

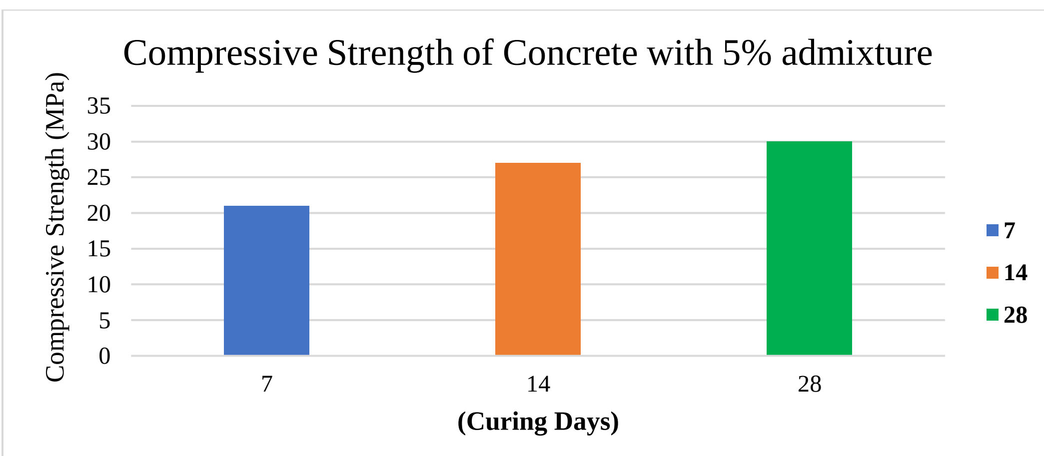

Figure 4.2 Compressive Strength of Concrete with 5% admixture

4.3.3 CS of Concrete with 10% admixture (Aboshio, 2009)

Here 10% rice husk ash is used as admixture.

Table 4.5 CS of Concrete with 10% admixture

Curing Duration date	Concrete Grade	Average Compressive Strength (MPa)
7	20	20
14	20	25
28	20	28

The height average of Compressive Strength of Concrete with 10% admixture is 28 MPa and the lowest is 20 MPa. We got the height average value at 28 days of curing.

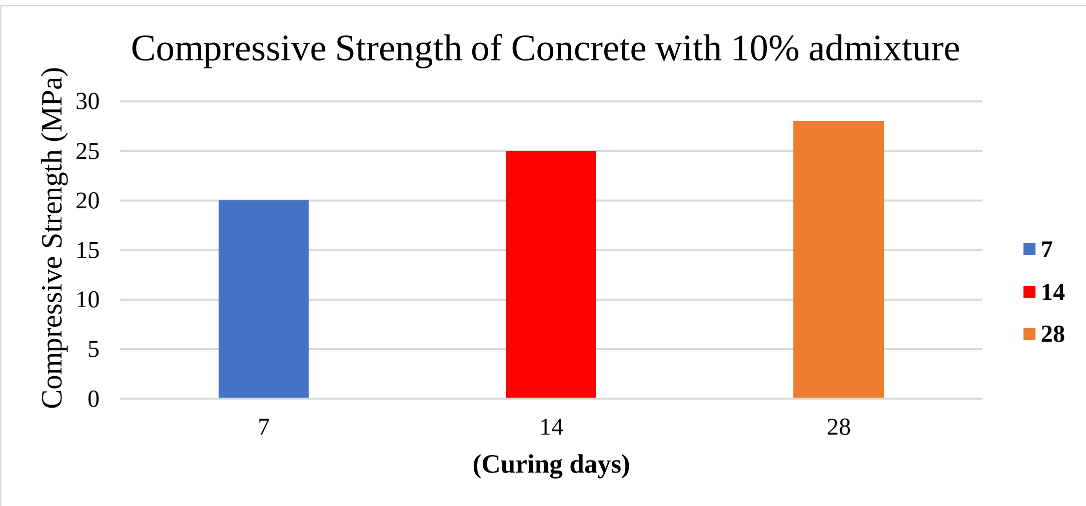

Figure 4.3 Compressive Strength of Concrete with 10% admixture

4.3.4 CS of Concrete with 15% admixture (Aboshio, 2009)

Here 15% rice husk ash is used as admixture.

Table 4.6 CS of Concrete with 15% admixture

Curing Duration date	Concrete Grade	Average Compressive Strength (MPa)
7	20	14
14	20	18
28	20	21

The height average of Compressive Strength of Concrete with 15% admixture is 21 MPa and lowest is 14 MPa. We got the height average value at 28 days of curing.

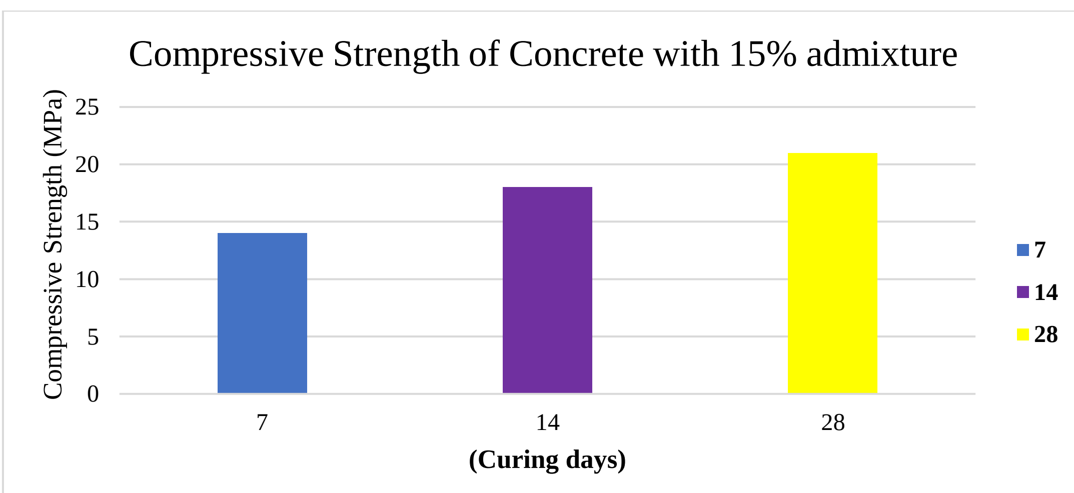

Figure 4.4 Compressive Strength of Concrete with 15% admixture

4.3.5 Compressive Strength of normal and all percentages of concrete using rice husk ash. (Aboshio, 2009)

Table 4.7 Regular concrete and concrete mixed with different amounts of rice husk

Specimen	W/C Ratio	Mix Ratio (20 Grade)	Curing Time	Normal Concrete (MPa)	5% (MPa)	10% (MPa)	15% (MPa)
Cylinder	0.5	1:1.5:3	7 days	19	21	20	14
			14 days	23	27	25	18
			28 days	27	30	28	21

Compressive Strength of normal and all percentages of concrete using rice husk ash for grade 20 concrete. Here also adding Cylinder specimen, water ratio, Mix ratio, and curing time.

4.3.6 Increase in compressive strength (MPa) for grades 20 Concrete with the addition of RHA after 28 days of curing variation. (Aboshio, 2009)

Table 4.8 After 28 days of variation of CS for grades 20 Concrete

	Without Admixture	**5%**	**10%**	**15%**
CS after curing 28days	27	30	28	21
Increment of strength	0	30- 27 = 3	28- 27 =1	21- 27 = - 6
Percentage increases	0	11.5 %	2.2%	-25%

After 28 days variation of CS for grades 20 Concrete is increment of strength for 5% is 3, 10% is 1, and 15% is -6. So, 5% is the height total increment of strength.

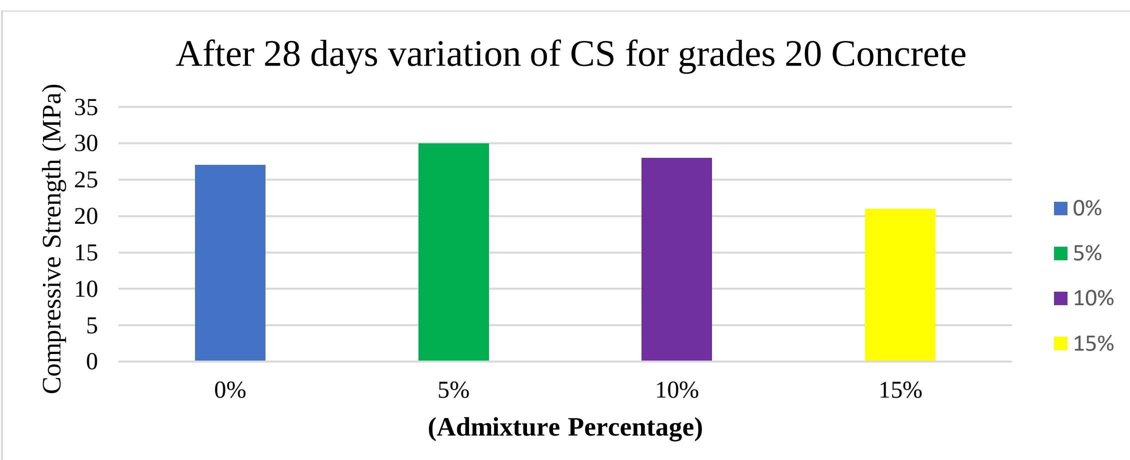

Figure 4.5 After 28 days variation of CS for grades 20 Concrete

4.3.7 **CS of Normal Concrete** (Jaturapitakkul, 2003)

Here no rice husk ash is used as admixture.

Table 4.9 CS of Normal Concrete

Curing Duration date	Concrete Grade	Average Compressive Strength (Mpa)
7	30	29
14	30	34
28	30	36

The height average of Compressive strength of normal concrete is 36 MPa and lowest is 29 MPa. We got the height average value at 28 days of curing.

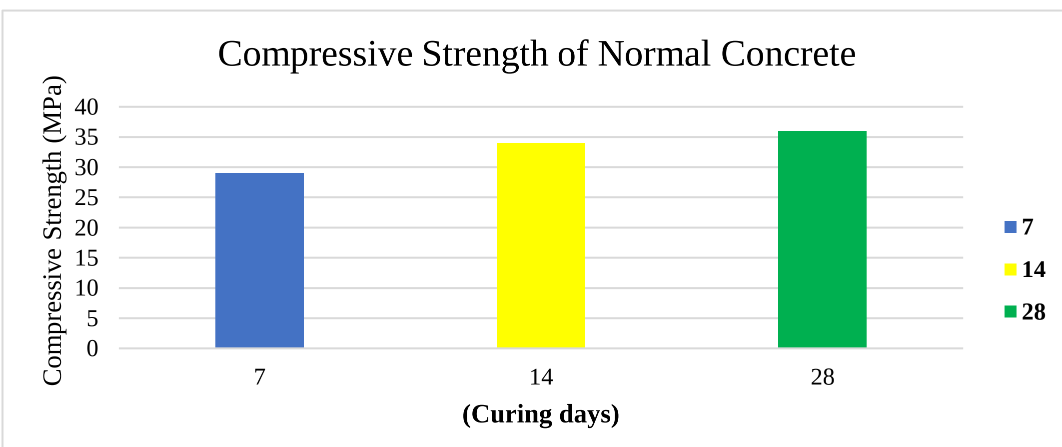

Figure 4.6 Compressive Strength of Normal Concrete

4.3.8 CS of Concrete with 5% admixture (Jaturapitakkul, 2003)

Here 5% rice husk ash is used as admixture.

Table 4.10 CS of Concrete with 5% admixture

Curing Duration date	Concrete Grade	Average Compressive Strength (Mpa)
7	30	31
14	30	40
28	30	46

The height average of Compressive Strength of Concrete with 5% admixture is 46 MPa and lowest is 31 MPa. We got the height average value at 28 days of curing.

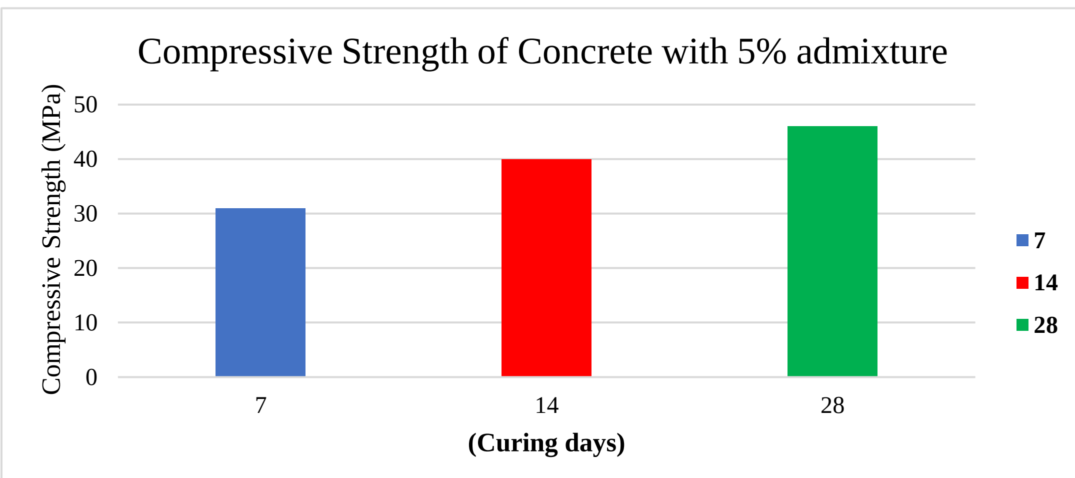

Figure 4.7 Compressive Strength of Concrete with 5% admixture

4.3.9 CS of Concrete with 10% Admixture (Jaturapitakkul, 2003)

Here 10% rice husk ash is used as admixture.

Table 4.11 CS of Concrete with 10% admixture

Curing Duration date	Concrete Grade	Average Compressive Strength (Mpa)
7	30	30
14	30	35
28	30	38

The height average of Compressive Strength of Concrete with 10% admixture is 38 MPa and lowest is 30 MPa. We got the height average value at 28 days of curing.

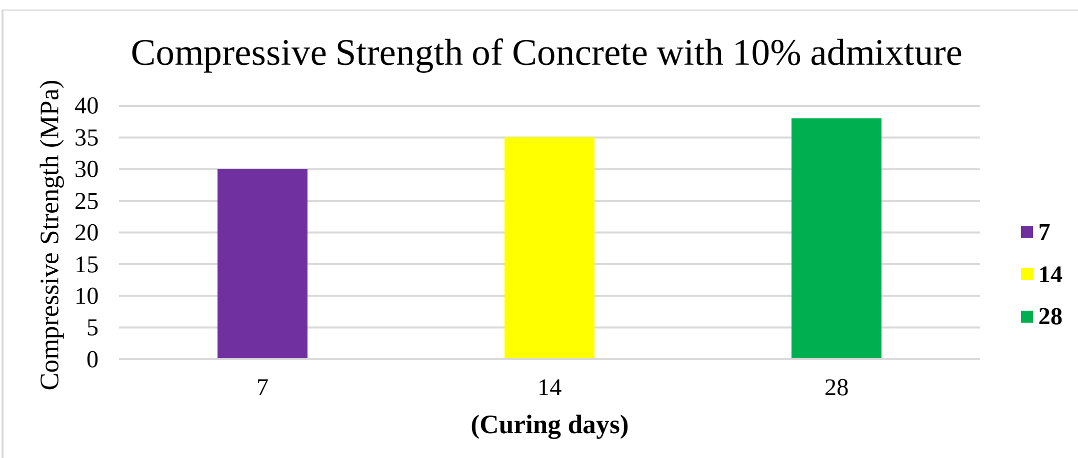

Figure 4.8 Compressive Strength of Concrete with 10% admixture

4.3.10 **CS of Concrete with 15% admixture** (Jaturapitakkul, 2003)

Here 15% rice husk ash is used as admixture.

Table 4.12 CS of Concrete with 15% admixture

Curing Duration date	Concrete Grade	Average Compressive Strength (Mpa)
7	30	23
14	30	26
28	30	33

The height average of Compressive Strength of Concrete with 15% admixture is 33 MPa and lowest is 23 MPa. We got the height average value at 28 days of curing.

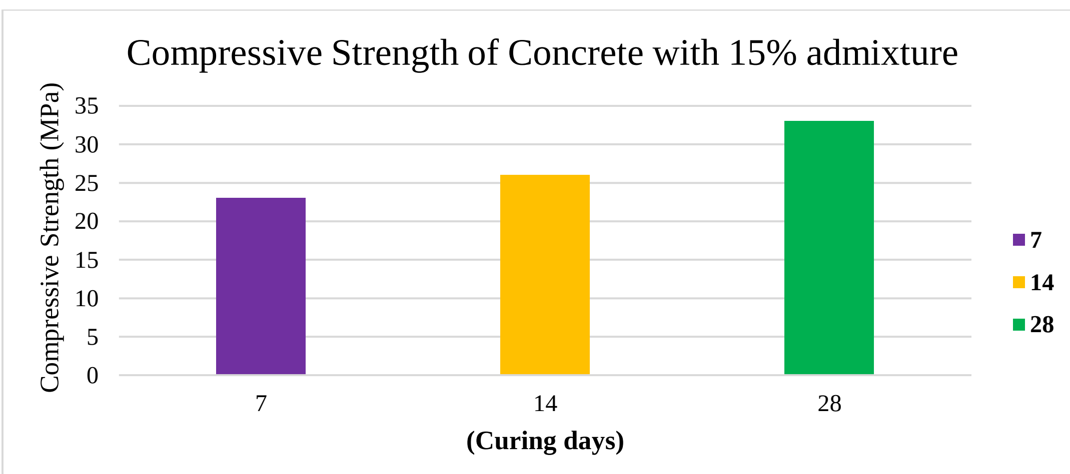

Figure 4.9 Compressive Strength of Concrete with 15% admixture

4.3.11 Compressive Strength of normal and all percentages of concrete using rice husk ash. (Jaturapitakkul, 2003)

Table 4.13 Regular concrete and concrete mixed with different amounts of rice husk

Specimen	**W/C Ratio**	**Mix Ratio (20 Grade)**	**Curing Time**	**Normal Concrete (MPa)**	**5% (MPa)**	**10% (MPa)**	**15% (MPa)**
Cylinder	0.5	1:0.75:1.5	7 days	29	31	30	23
			14 days	34	40	35	26
			28 days	36	46	38	33

Compressive Strength of normal and all percentages of concrete using rice husk ash for grade 30 concrete. Here also adding Cylinder specimen, water ratio, Mix ratio, and curing time.

4.3.12 Increase in compressive strength (MPa) for grades 30 Concrete with the addition of RHA after 28 days of curing variation (Jaturapitakkul, 2003)

Table 4.14 After 28 days variation of CS for grades 30 Concrete

	Without Admixture	5%	10%	15%
CS after curing 28days	36	46	38	33
Incrementof strength	0	46- 36 = 10	38- 36 = 2	33- 36 = - 3
Percentage increases	0	32.35 %	7.65%	-12%

After 28 days variation of CS for grades 20 Concrete is increment of strength for 5% is 10, 10% is 2, and 15% is -12. So, 5% is the height total increment of strength.

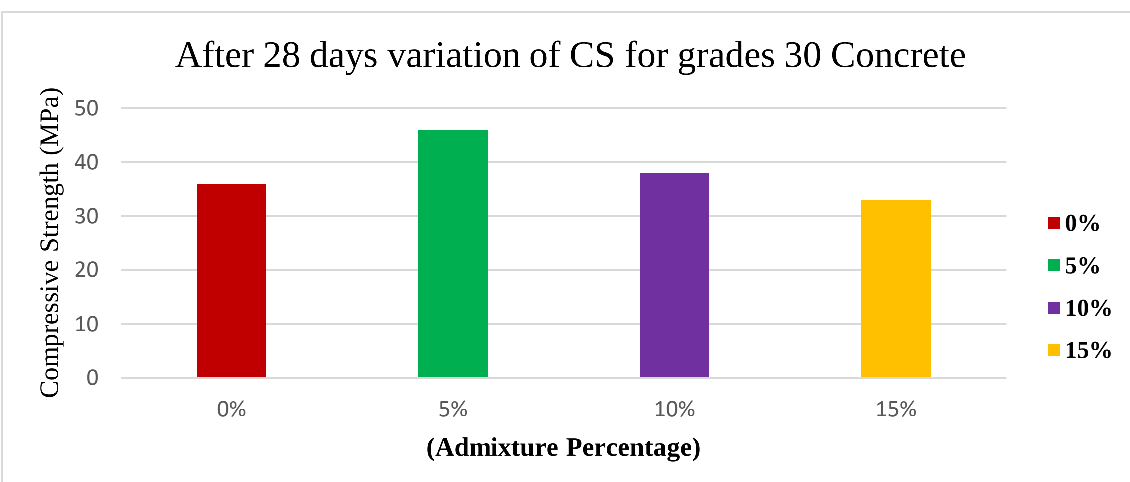

Figure 4.12 After 28 days variation of CS for grades 30 Concrete

CHAPTER 5

DISCUSSION AND RECOMMENDATION

5.1 General

This chapter describes how compressive strength can be enhanced by including rice husk as a natural additive. These will be beneficial in the end and aid in the construction of an excellent concrete structure.

5.2 Conclusion

Based on the research conducted, the following conclusions could be drawn

1. For 20 concrete grade, The height slump value is 28, when adding 15% rice husk ash and the lowest slump value is 17 when adding 0% rice husk ash. In the same way, for 30 concrete grade, The height slump value is 19, when adding 15% rice husk ash and the lowest slump value is 12, when adding 0% rice husk ash.
2. For 20 concrete grade, The height Water absorption value is 2.26, when adding 0% rice husk ash and the lowest slump value is 1.73 when adding 15% rice husk ash. In the same way, for 30 concrete grade, The height slump value is 2.10, when adding 0% rice husk ash and the lowest slump value is 1.58 when adding 0% rice husk ash.
3. The addition of 5% and 10% RHA enhanced the compressive strength of grade 20 and 30 concrete that had been cured in water. However, it increases more with a 5% addition than a 10% addition, but it decreases when a 15% addition of RHA is added.

5.3 Recommendations

The following criteria were important for further study on this subject.

1. Based on the investigation's results, it is advised that concrete of grades 20 and 30 with 5% RHA be used as an admixture to increase the concrete's compressive strength in non-aggressive environments, but not in aggressive environments containing HCl, HNO_3, or H_2SO_4.
2. Consider the benefits of using rice husk for the environment and promote eco-friendly construction practices. There are environmental advantages to using rice husk instead of traditional cementitious materials, which should be mentioned.
3. High quality sources of information can produce better outcomes.

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