VARIATION IN THE STRENGTH PROPERTIES OF CEMENT MORTAR MADE WITH SAWDUST

By

Farzana Yesmin

Md.Sohag Mia

Md.Mohaimenul Islam

A thesis submitted to the Department of Civil Engineering in partial fulfillment for the degree of Bachelor of Science in Civil Engineering

Department of Civil Engineering
Sonargaon University
147/I, Green Road, Dhaka-1215, Bangladesh

Section: 16E
Semester – Fall-2022

VARIATION IN THE STRENGTH PROPERTIES OF CEMENT MORTAR MADE WITH SAWDUST

By

Farzana Yesmin	ID: BCE1901016150
Md.Sohag Mia	ID: BCE1901016269
Md.Mohaimenul Islam	ID: BCE1901016132

Supervisor
Monirul Islam
Lecturer
Department Of Civil Engineering
Sonargaon University

A thesis submitted to the Department of Civil Engineering in partial fulfillment for the degree of Bachelor of Science in Civil Engineering

Department of Civil Engineering
Sonargaon University
147/I, Green Road, Dhaka-1215, Bangladesh

Section: 16E
Semester - Fall-2022

BOARD OF EXAMINERS

The thesis titled "Variation in The Strength Properties Of Cement Mortar Made With Sawdust" submitted by Farzana Yesmin, ID: -BCE1901016150; Md. Sohag Mia, ID: - BCE1901016269; Md. Mohaimenul Islam, ID: - BCE1901016132, has been accepted as satisfactory in partial fulfillment of the requirement for the degree of Bachelor of Science in Civil Engineering on 20 January 2023.

……………………………………

Monirul Islam
Lecturer
Department Of Civil Engineering
Sonargaon University

Chairman

……………………………………

1. Internal / External Member

Member

……………………………………

2. Internal / External Member

Member

DECLARATION

We hereby declare that this report is our own work and effort and that it has not been submitted anywhere for any award. All the contents provided here is totally based on our own labor dedicated for the completion of the laboratory experiment of volume study of the road lying near to our university. Where other sources of information have been used, they have been acknowledged and the sources of information ‘have been provided in the reference section.

STUDENT NAME	STUDENT ID.	SIGNATURE
Farzana Yesmin	BCE1901016150	
Md.Sohag Mia	BCE1901016269	
Md.Mohaimenul Islam	BCE1901016132	

Dedicated

to

"Our Family and Honorable Teachers."

ACKNOWLEDGEMENTS

Despite our best efforts, a lot depends on the support and guidance of many others for this dissertation to be successful. We would like to take this opportunity to thank everyone who helped this thesis be completed successfully. First and foremost, we would like to praise and thank Allah, the Almighty, for giving the writer countless blessings, opportunities, and knowledge that allowed us to finish the thesis. Without these things, we would not have been able to finish this work by the deadline. We want to convey our sincere appreciation to the Sonargaon University Department of Civil Engineering, who served as our guide.

We want to start by expressing my gratitude to my supervisors Monirul Islam, Lecturer Department of Civil Engineering Sonargaon University, for his continuous support and direction during this project.

Last but not least, a hearty thanks you to my University of Sonargaon colleagues for their time and work during my project, whether it included shoveling, sifting, casting, or batching. Without your assistance, this work would not have been possible.

ABSTRACT

The behavior of building blocks with the partial replacement of fine aggregates by sawdust is evaluated. The parameter adopted comprised analysis of the compressive strength according to the treatment applied to sawdust residue. Blocks were composed by replacing fine aggregates by sawdust at 5% weight. Before mixing the wood residues to the concrete, the former underwent treatment so that wood residues could be compatible with the cement matrix. Two treatment processes were investigated. The first treatment comprised the washing of residues in an alkaline solution (lime) at a 5% proportion (weight / weight). The second treatment comprised the immersion of the residue in aluminum sulfate. Analysis was undertaken from compressive strength assays of the blocks on the 7th and 28th day. Results showed low efficiency in the alkaline-based treatment (lime) and good performance in the aluminum sulfate-based treatment. The production of masonry blocks with a replacement of 5% fine aggregates for this type of treatment and species studied is possible. This paper reports on experimental investigations on the effect of replacing sand with sawdust on the properties of concrete. A concrete mix of 1:2:4 was used as control while sawdust was used to replace 25%, 50%, 75% and 100% of sand by volume. The percentage reduction in density is 5.96%, 12.44%,13.56% and 17.93% respectively while the corresponding percentage reduction in compressive strength were 57.5%, 68.1%, 83.7%, and 87.3% respectively[1]. The results of the study indicate that both the density and compressive strength of concrete decreased as the percentage replacement increased but replacement of sand by sawdust produced a higher percentage reduction in compressive strength than in density. Sawdust can potentially be used as aggregate in the production of both non-structural lightweight concrete and structural concrete. However, further research should be conducted to establish its suitability as aggregate in concrete [1]

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1
INTRODUCTION

1.1 Background and Motivations

In recent years, researchers have made great efforts to build sustainable building materials. No, the main reason is that building materials such as cement, sand, and gravel cause a lot of damage to the environment pollution and carbon dioxide emissions. as a solution for realization sustainable architect different types cement substitutes which are often products of other companies in various aggregates representation has subject of many research. The possibilities using local material partial or total replacement of cement or aggregate in concrete or mortar. Most of all these are often labeled as expensive ingredients. The problem of the accumulation of unprocessed waste, especially in developing countries, has led to an increase environmental concern. Recycling this waste seems like viable solution isn't it not only for pollution problems but also for the economy of building design. Growth and the process of using environmentally friendly, inexpensive and light weight building materials in the construction industry has made it necessary to study how this can be done. obtained and how it benefits the environment[1]. In the early 1990s, many studies were conducted to use Free in various types of production. For example, using paper sludge, Glass powder, plastic waste and palm oil powder in concrete mixes have achieved outstanding results interest in studies. Sawdust waste is one such material production of concrete or cement. Sawdust is a by-product of sawdust milling or conversion of wood into different shapes and sizes. Use of free sawdust can not only solve environmental problems, but also can protect people natural resources of building materials. It has great features, like a small footprint density, high temperature storage and low thermal and sound conductivity, and strength reduce environmental pollution resulting from the disposal of such wastes in nearby areas and country of residence. The physical and chemical properties of sawdust diversity download depend on many factors depending on the type and specification of wood. The collection of sawdust well free of charge in many places where the art works, especially in developing countries like Libya, can cause some serious environmental problems and health risk. This study presents an experimental work that examines those things the possibility of using sawdust to create a suitable lightweight weapon. Some mechanical properties of the mixture with different levels of sawdust free is research. Good results can be achieved by using sawdust in building applications that can pave the way for the use of other agricultural wastes such as straw; which will get more benefits for environmental protection [2].

1.2 Research Objectives and Overview

- To determine compressive strength test between ordinary Cement block & sawdust cement block.
- To make light wait cement block using sawdust.

1.3 Organization of the thesis

This section should have a brief description of the thesis outline of the thesis. It should contain chapter no. with a title and brief descriptions of the content of each chapter. An example guide is provided below.

Chapter 1: Introduction and Objective. This chapter provides the background and motivations of the research. The overall objectives and expected outcomes are also described in this chapter.

Chapter 2: Literature Review. This chapter which gives an understanding of the various work carried on this field by different authors and describe properties of material used.

Chapter 3: Methodology. This chapter describes the methodology adopted to carry out the research.

Chapter 4: Results and Discussion. This chapter describes the experimental results of various tests carried on concrete and a comparative analysis of the results with the help of tables and graphs.

Chapter 5: Conclusions and Future Work. This chapter summarizes the conclusions and major contributions of this study and provides recommendations for future studies.

CHAPTER 2
Literature Review

2.1 Introduction

In recent years, researchers have made great efforts to build sustainable building materials. No, the main reason for this is because of the fact building materials such as cement, sand, and gravel cause a lot of damage to the environment pollution and carbon dioxide emissions. As a solution for the realization cement substitutes which are often products of other companies in various aggregates representation has been the subject of many research. Granulated ground blasted slag and fly ash have been used successfully in many places material with the intention of reducing or replacing completely using cement[2].

On the other hand, the use of the collection also presents serious environmental problem because the number of collections is usually 60-75% and concrete and mortar and it comes from natural Rivers or volcanic rock[3].

Substitution of total aggregates and other possible things also overcome this special attention recently. Recycled materials which usually comes from the destruction of the structure Solid waste (CDW) has been identified as its representative natural aggregates although the new properties. The physical properties are a little lower for things it was made with a reusable package compared to their common stage. Mortar is the main component of concrete as well are often used as home staples at low-cost construction of houses especially in construction using brick, block or masonry[3].

Other ways and will be born since the weapon are needed the sand that is present natural beach sand and crushed stone. Sawdust, nothing products from the plant production process, can be used as a substitute for sand and has been shown to be effective according to the literature information. Bio-composites made of gypsum and 20% of in addition to sawdust showed promising mechanical properties. However, prepare for fillers and coatings. For free sawdust can be effectively used in normal production Lightweight concrete and lightweight compact[4].

Addition sawdust and what affects many properties in some places some of them are bad while some of them are good. Guarantees new and improved properties strength of geopolymer fly ash added to sawdust. The paste was identified in a recent study. The sawdust content has a direct effect on the timing, density, compressive strength and flexural strength of geopolymer clay. Properties of sawdust additional building materials, such as wood concrete, depending on the initial condition of the treatment sawdust[4].

Sawdust treated with hot water or boiled in water with the addition of alkali has a positive effect on performance of wood computers. The compression power can increase from about 30% to 260% for Treatment comes from hot water and 4% hot water Treatment with sodium hydroxide (NaOH), respectively. Sawdust can be used as the only good material available make a tree. Compressive strength, However, the strength can be as low as 0.8 MPa. The sawdust is it is also widely used in the manufacture of low-density panels; however, the trunk cannot be used for structural or load bearing purposes the target is spinning due to poor mechanical performance material. Sawdust adds durability to building materials has not been fully explored though the effect of sawdust and sunlight can be very important and useful. Again, many of birth except very few considered adding sawdust without adding before the treatment of may not produce relevant results mechanical and physical properties. So, this the study seeks to examine the process of planning[5].

2.2 Content

2.2.1Cementitious materials

Cement is considered one of the most important building materials around the world. It is mainly used for the production of concrete. Concrete is a mixture of inert mineral aggregates, such as sand, gravel, crushed stones, and cement. Cement consumption and production is closely related to construction activity, and therefore to general economic activity. Cement is one of the most produced materials around the world [2]. However, every 1 ton of cement produced leads to about 0.9 tons of CO_2 emissions and a typically concrete contains about 10% by weight of cement. Approximately, 95% of all CO_2- emissions from concrete production are from cement manufacturing . The 1600 Mt of cement consumption in 2000 over the world will increase almost two-fold to 2880 Mt by 2030, implying an annual 2% growth rate. Among these shows that most growth takes place in the developing regions. However, the production of Portland cement, an essential constituent of concrete, leads to the release of a significant amount of CO_2 and other greenhouse gases (GHGs) [6].

The construction industry has an enormous environmental footprint on Planet Earth. In addition, the energy requirements, water consumption and generation of construction and demolition waste, these factors contribute to the general appearance that concrete is not particularly environmentally friendly or compatible with the demands of sustainable development [3]. Therefore, it is necessary to look for sustainable solutions for future concrete construction. Alternative solution could be the use of environmental-friendly ("green") concrete to enable world-wide infrastructure-growth without increase in CO_2- emission. This can be achieved by reducing the quantity of concrete used in buildings, to replace as much Portland cement as possible by supplementary cementitious materials, especially those that are by-products of industrial processes, such as fly ash, rice husk ash, palm oil fuel ash, slag, metakaolin and silica fume, and use that concrete wisely [7].

2.2.2 PORTLAND CEMENT

A cementitious material is one that has the adhesive and cohesive properties necessary to bond inert aggregates into a solid mass of adequate strength and durability. For making structural concrete, hydraulic cements are used exclusively. Water is needed for the chemical process called hydration in which the cement powder sets and hardens into one solid mass. Portland cement is a finely powdered, grayish material that consists chiefly of calcium and aluminum silicates. The common raw materials from which it is made are limestone, which provide CaO and clays or shale which furnish SiO2 and Al2O3. These are ground, blended, fused to clinkers in a kiln and cooled. Gypsum is added and the mixture is ground to the required fineness [7]

2.2.3 Composition of Portland Cement

The raw materials used for the manufacture of cement consists mainly of lime, silica, alumina and iron oxide. These oxides interact with each other in the kiln at high temperature to form more complex compounds. The relative proportions of these oxide composition are responsible for the various properties of cement in addition to rate of cooling and fineness of grinding. Composition of Portland cement are divided into two categories:

1)Acid Alkaline Composition
2)Mineral Composition

Table 2.1 and Table 2.2 show that the name and approximate limits of Acid Alkaline and Mineral Composition of Portland cement respectively [8].

Table 2.1: Acid Alkaline Composition and the approximate limits[6]

Sl. No.	Constituents	Composition	Range of Percentage
1.	Calcium Oxide	CaO	60-67
2.	Silica	SiO_2	17-25
3.	Alumina	Al_2O_3	3-8
4.	Iron Oxide	Fe_2O_3	0.5-6
5.	Magnesium Oxide	MgO	0.1-4
6.	Sulphur Trioxide	SO_3	1-3
7.	Potassium Oxide	K_2O	0.3-1

8.	Sodium Oxide	Na_2O	0.4-1.3
9.	Loss on ignition	---	1.8-2
10.	Insoluble residue	---	0.3-0.5

Table 2.2: Mineral Compositions and the approximate limits [8]

Sl. No.	Name of Compound	Mineral Composition	Abbreviation	Range of Percentage
1.	Di Calcium Silicate	$2CaO.SiO_2$	C_2S	20-30
2.	Tri Calcium Silicate	$3CaO.SiO_2$	C_3S	45-55
3.	Tri Calcium Aluminate	$3CaO.Al_2O_3$	C_3A	9-13
4.	Tetra Calcium Alumina Ferrite	$4CaO.Al_2O_3.Fe_2O_3$	C_4AF	8-20
5.	Calcium Sulfate	$CaSO_4$	---	2-6
6.	Other Compounds	---	---	2-8

The calculation of the potential composition of Portland cement is based on work of R. H. Bogue and others, and is referred as "Bogue Composition"[8]. Bogue (1971) equation for the estimation of the percentage of major compositions of cement is given below:

C3S = 4.07(CaO)–7.60(SiO2)– 6.72(Al2O3) – 1.43(Fe2O3) – 2.85(SO3) – 5.2(CO2)4(i)

C2S = 2.87(SiO2) – 0.754(3CaO.SiO2)

C3A = 2.65(Al2O3) – 1.69(Fe2O3)

C4AF = 3.04(Fe2O3)

The oxides shown in the brackets are the percentage amount of these oxides determined experimentally for the given cement example [8].

Among the four main compounds, C3S and C2S are the most important composition. These are responsible for the strength of hydrated cement paste. C3A contributes little strength of cement but it forms calcium chloroaluminate (ettringite) during sulfate attack. C3A also facilitates the combination of lime and silica. C4AF reacts with gypsum to accelerate the hydration of the silicates [8].

2.2.4 Fine Aggregate

Fine aggregates are essentially any natural sand particles won from the land through the mining process. Fine aggregates consist of natural sand or any crushed stone particles that are ¼” or smaller. This product is often referred to as 1/4’” minus as it refers to the size, or grading, of this particular aggregate. Fine aggregate is the essential ingredient in concrete that consists of natural sand or crushed stone. The quality and fine aggregate density strongly influence the hardened properties of the concrete.

Fine aggregates are classified as follows:

- Mode of Origin
- Composition
- Grain Size

The concrete or mortar mixture can be made more durable, stronger and cheaper if you made the selection of fine aggregate on basis of grading zone, particle shape and surface texture, abrasion and skid resistance and absorption and surface moisture[9].

2.2.5 Sawdust

Saw dust used in this research work was collected from the woodwork shops in and around city. The material in its original form was brought to the laboratory and sorted for unwanted debris. Then, the material was burnt followed by grinding to fine powder. The sieving of the material was done to ensure its fineness equal to the fineness of the cement. The sawdust is a commercially available source unknown type with different particle sizes and shapes. However, to maintain a good mortar mix, the large and long particles were removed by sieving. The maximum particle size was kept at 1.18 mm. Sieved sawdust has about 65% passing percentage at 600 µm and 30% passing percentage at 300 µm. Fig. 1 (a) shows the particles used in this study obtained after sieving (small) and Fig. 1 (b) shows particles left after sieving (large). Large particles are not efficient in obtaining a workable mortar mix due its nature where particles are long and thin than round and solid. Fig. 2 shows the particle size distributions of both fine aggregate and sawdust. The estimated effective specific gravity of sawdust using preliminary tests was taken as 0.33[10].

Figure 2.1: Segun Sawdust

2.3 Summary

To knowledge about all of materials need essential part to completed methods easily. Materials took everything part by part details analysis impact to us. This this chapter we know about Portland cement, Shylet sand, Sawdust etc detailing. To complied our process's part by part every depriving element need our potential impact to complied it.

CHAPTER 3

Methodology

3.1 Introduction

Dosage analysis is mandatory to select the material available in the region for the production of concrete blocks. Consequently, the best ranges of particle size compositions, coarse-fine aggregate ratios and binder aggregate ratio were investigated in current tests. Dosage analysis, based on the ABCP method (FERREIRA JÚNIOR, 1995), aimed at finding the best ratio between fine and coarse aggregates through the highest compactness possible. Ratio ranges between aggregates (20/80, 25/75, 30/70, 35/65, 50/50 and 60/40) were defined and compactness was evaluated by the mass unit obtained from the mixture and its density achieved by metal socket. Aggregates were pre-mixed and placed in a metal container of known volume, with the edge fitted with a wooden frame for the settling of material. After the compacting of the mixture, mass values were determined and an optimum compactness curve was found. The graph defined the reference mark with the best performance in mass unit proportion among aggregates; or rather, the 50/50 ratio which had the greater mass. Reference was consequently defined. Table 5 shows the elaboration of 4 proportions, two of which would be richer in binder, according to studies for precast blocks (ALVES, 2004). The ratio binder: aggregate and moisture content were subsequently analyzed. Results showed the behavior of the mixture with regard to molding consistency and to subsequent compressive strength. The best proportion of materials for the production of blocks was determined and the best reference mark to replace 5% sand by sawdust was defined after the analysis of compressive strength. As a parameter for initial evaluation, mixture consistency was analyzed according to the exact point in pellet formation, characteristic of dry concrete. Mixture compactness was obtained according to the equipment adopted for concrete block production or vibrating press. Water rate is an extremely important factor that should be analyzed meticulously in dry consistency concrete blocks. The ideal percentage of water varies between 4 and 7% of the mass of dry materials. However, in 1:5 and 1:7 reference marks, segregation of material at molding and compactness in the machine and non-formation of pellets occurred. Consistency, which is directly related to the amount of water used in these reference marks, failed to be satisfactory. The above facts are related to the characteristics of materials used in current test and which differ from materials usually employed in other regions of Brazil. Consequently, the same water rate should not be employed. Pebbles are highly brittle, or rather, there is up to 30% sand in their composition[9]. Whereas a horizontal-axis cement mixer was used for concrete mixing, a semi-automatic vibrating press was used for block molding. The amount of time taken for mixing the material in the mixer and maximum vibrating compression time were evaluated so that the de-molding of the concrete would not occur, while cracks in the sides of the blocks and the segregation of material during compression would be avoided. The amount of time required usually depended on the type of equipment used in molding and on synchronization of block production team (mixing and molding). Maximum of 3 minutes for the mixture and 2 minutes for vibration-compaction was determined for current study. A set of three blocks was produced for each molding and then stored for initial curing. The blocks were transported on supporting pallets to an open space protected from direct sunlight. Two hours after molding, the curing process started. Curing lasted 24 hours during which the blocks were covered with a moist blanket and water sprayed every 2 hours. On the third day the batch was taken to the laboratory of materials, coated for surface regularization and tested for compressive strength in an ASMLER universal machine (1000 kN), following NBR 7184 (ABNT, 1992). Test results must meet the NBR7173 (ABNT, 1982b) standards which determine minimum compressive strength of 2.0 MPa for the individual block and an average 2.5 MPa so that the blocks may be used in buildings [9].

3.2 Process:

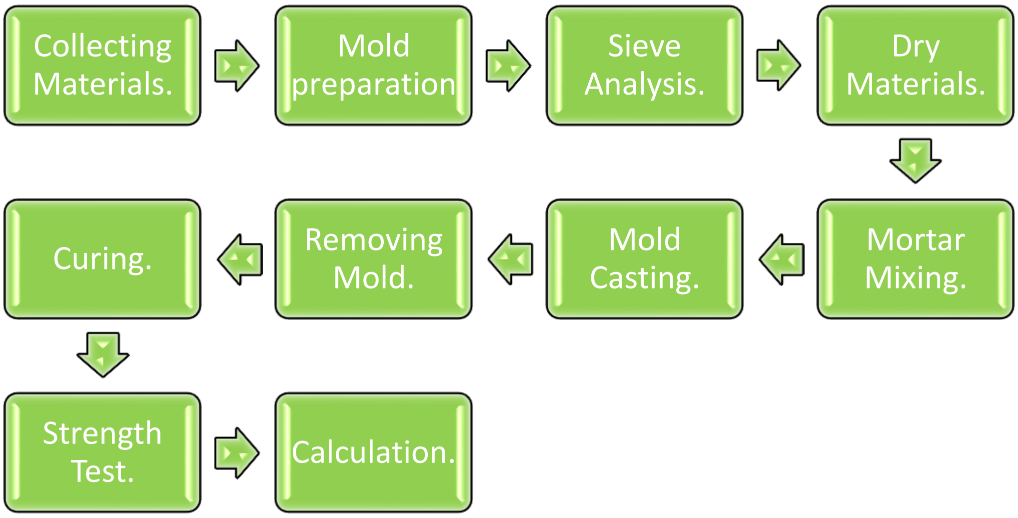

Figure 3.1: Working process

To compare variation of strength properties we should take two steps
Step-1: Making Cement mortar without using sawdust for strength properties.

Step-2: Making Cement mortar with using 5% sawdust for strength properties.

1.Without sawdust making block:

Step- 1:
In our study, constant mix proportion (1:3) was adopted. The amounts of different ingredients for one specimen are shown in the following calculation -
Volume of the Block Mold = 8 in3 = 0.000579 * 8 = 0.004632cft
Dry Volume, 0.004632 * 1.5 = 0.006948 cft
Quantity of cement = 0.006948 *1/4
= 0.001737 cft / 1.22 bag
= 0.001424 bag = 0.001424 * 50 kg
= 0.0712 kg = 0.0712*1000 = 71.2 gm = 72 gm
Quantity of sand = 72*3 = 216 gm

For 3 set or 9 Pcs Block mold;
Cement = 72 * 9 = 648 gm
Sand = 216*9 = 1944 gm

- **W/C Ratio**

There we take, Water/Cement Ratio 0.5
So that, Water = 648*0.5 gm
= 324 gm

For making cement block using Cement, sand and water Ratio:
Cement: - 648 gm
Sand: - 1944 gm
Water: - 324 gm

Figure 3.2: Mixing Cement, Sand & Water

After mixing ratio then ready block mold for made block in size.

Figure 3.3: Cement mortar Block Molding

After that rest this in one day & after that remolding from mold & curing under water

Figure 3.4: Remolding Cement Block

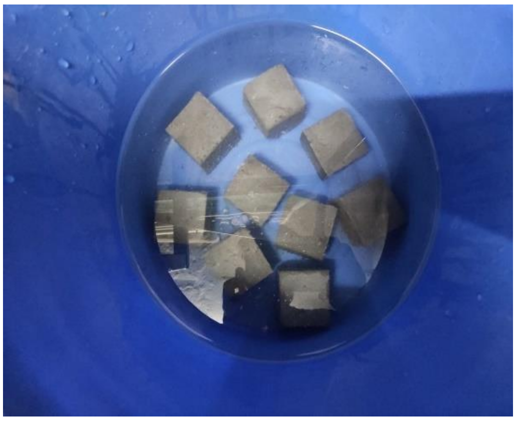

Figure 3.5: Curing Cement Block

1.With sawdust making block:

Step- 2:

Using 5% sawdust replace of sand

For 3 set or 9 Pcs Block mold;

Cement = 72 *9 = 648 gm

Sand = 216*9 = 1944 gm

= 1944 – 98 = 1846 gm

Sawdust = 1944*5%

= 97.2 gm = 98 gm

In this process we just adding Sawdust 5% replacing sand.

Ratio:

Cement: - 648 gm

Sand: - 1846 gm

Water: - 324 gm

Sawdust: - 98 gm (5%)

Figure 3.6: Mixing Sawdust

After mixing sawdust are same policy of part one and after all set remolding the Block and curing in water.

Testing of the specimen

I. Apparatus

a. The testing machine used to test the compressive strength of concrete cylinders was a hydraulically operated testing machine of 3000 KN capacity.

II. Placing of the specimen

The lower bearing plate was placed with fixed hardened face up on the table of the testing machine directly under the upper bearing plate. The bearing faces of the test specimen were

wiped clear and the test specimen was placed on the lower bearing plate. The axis of the specimen was carefully aligned with the center of the upper bearing plate.

Crushing of the specimen

The load was applied continuously without shock. No adjustment was made in the controls of the testing machine while a specimen was yielding rapidly, immediately before failure. The compressive strength of the concrete was calculated, dividing the maximum load carried by the specimen by the average cross-sectional area of the specimen.

Figure 3.7: Universal Testing Machine

Notice

- All specimens will be cured on the laboratory room temperature up to the date of test.
- Portland composite cement will be used.
- Medium workability is maintained.

3.3 Summery

Further studies are needed to enhance the knowledge on the interaction between sawdust and cement and how it affects the hydration reaction. In addition to that the durability of sawdust added cementitious materials should be extensively investigated with the aim of practical use of these materials even at low-cost constructions

CHAPTER 4
Results and Discussion

4.1 Results

The test was carried out confirming to IS 516 – 1959 to obtain compressive strength of concrete at the age of 14, 28 days. The cubes were tested using Compression Testing Machine (CTM) of capacity 3000 KN.

Table 4.1: Without sawdust Ratio

Cement	648 gm
Sand	1944 gm
Water	324 gm

In our concrete block we used 3 materials, those are as follows cement 648 gm, sand 1944 gm, water 324 gm. This ratio is without sawdust.

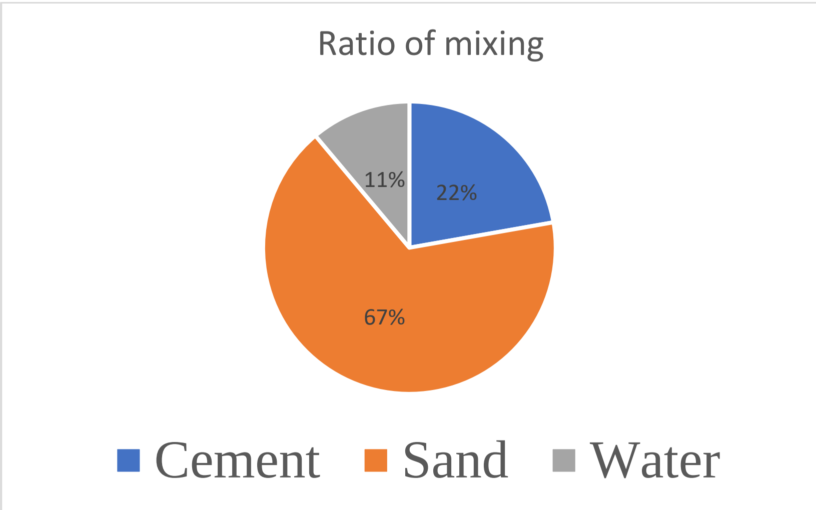

Figure 4.1 : PIE Chart of Ratio of Mixing

Here the pie chart shows the ratio between our 3 key materials without sawdust. The ratio for Cement: Sand: Water is 22%: 67%: 11%

Table 4.2: Without sawdust Result data collection

SL	Days of Test	Sample Result	Average
1	7 Days	17 KN	18 KN
2		19 KN	
3		18 KN	
1	14 Days	22 KN	21.66 KN
2		21 KN	
3		22 KN	
1	28 Days	29 KN	29.33 KN
2		28 KN	
3		31 KN	

We get for our Materials Without Sawdust Result 7 days Average 18 KN, 14 Days Average 21.66 KN & 28 Days Average 29.33 KN.

Table 4.3: - With sawdust Ratio

Cement	648 gm
Sand	1846 gm
Water	324 gm
Sawdust	98 (5%)

In our concrete block we used 4 materials, those are as follows cement 648 gm, sand 1846 gm, water 324 gm with sawdust 5%.

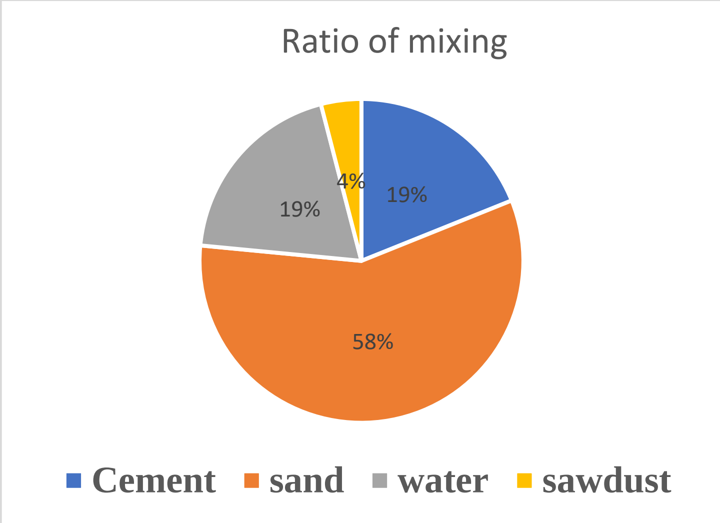

Figure 4.2: PIE Chart of Ratio of Mixing

Here the pie chart shows the ratio between our 4 key materials with sawdust. The ratio for Cement: Sand: Water: Sawdust is 19%: 58%: 19%: 4%

Table 4.4: With sawdust Result data collection

SL	Days of Test	Sample Result	Average
1	7 Days	10 KN	11 KN
2		12KN	
3		11 KN	
1	14 days	14 KN	15 KN
2		16 KN	
3		15 KN	
1	28 Days	21 KN	19.66 KN
2		19 KN	
3		19 KN	

We get for our Materials With Sawdust Result 7 days Average 11 KN, 14 Days Average 15 KN & 28 Days Average 19.66 KN.

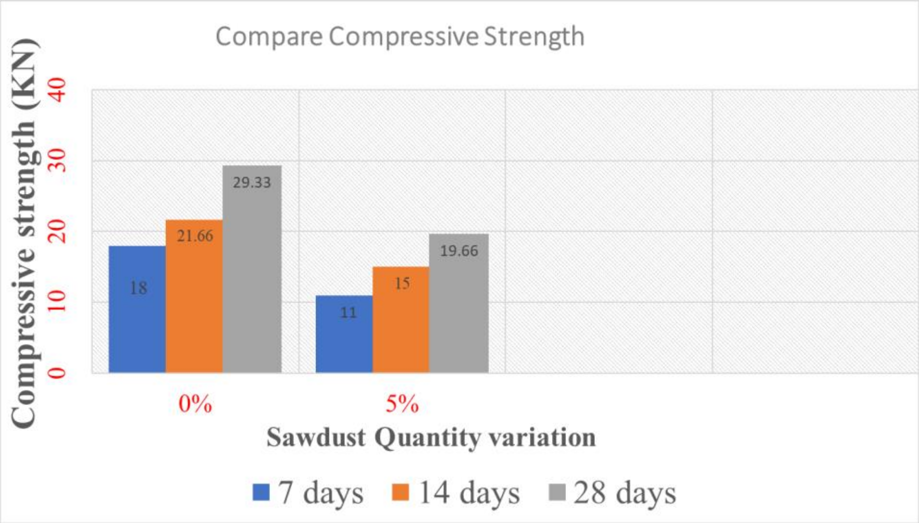

Figure 4.3: Compare Compressive Strength Without Sawdust Vs With 5% Sawdust

Show This figure compare without sawdust compressive strength and with sawdust compressive strength test .

4.2 Summary

The results of this study report experimental data of mortar specimens cast with sawdust as a replacement material for fine aggregates. In addition to that, results of a brief investigation of pre-treatment of sawdust are presented. Although the experimental cases are very limited, some interesting and valuable conclusions can be drawn as listed below[10]. Sawdust must be pre-treated if used with cementitious materials to achieve comparatively better mechanical properties. Boiling with NaOH for 2 hours and washing with boiling water for 30 minutes has shown better performance in mechanical properties.

CHAPTER 5
Conclusions and Future Works

5.1 Conclusions

The analysis showed differences in each sample tested. Since then, the power of the model has been modified to explore other areas of research. The treatments were as follows: the seven-day sample received no treatment, the fourteen-day water was sprayed, and the twenty-eight-day water was sprinkled every morning. Among the three samples, the sample that showed the highest compressive strength was 7 days untreated. The first research described the healing process of the seven days as if the sawdust particles in the concrete that bring water before the mixing time help hydrate. the middle section makes it reach high compressive strength at such a time. The proportions of the group are also different since after two control samples, the sawdust-cement-gravel mixture showed a weight reduction of almost 10% and filled the floor slabs [10].

Almost 40% of the weight of the structure, it can help reduce weight subsequent floors, eliminating the need to create critical columns in previous floors. In terms of cost, the price of sawdust per bag compared to sand is also lower than it used to be because sawdust has become waste. Another finding is when the specimen breaks due to bending stress. Models built with standard computerized machines immediately explode and even fall to the ground as soon as their performance limits are reached. In contrast, the sawdust-cement-gravel materials are combined with small wood chips. This can bring a bonus when it comes to sawdust; this can help keep things contained within the cave, giving people time to escape. In terms of workability, consistency and high texture, incorporating sawdust into the mix has increased workability as it becomes soft and compact when wet, although it can be hard a little consistent, which makes let it a bit harder to melt as pieces of sawdust usually do. appear during smoothing. In terms of surface texture, sawdust produces a dark brown color that looks a bit like recycled paper. Sawdust can be said to add to the ambiance of the room by giving the impression of old wallpaper. In addition to experimentally based conclusions, some previously published conclusions from previous research are included. Its acoustic insulation

If installed in floor panels, noise and vibration can be reduced for people living in basements with sawdust-cement-gravel floors, soundproofing using natural insulation so to speak. Its thermal design can keep hot or cold longer than its standard compact counterparts. Air circulation and the use of air conditioning devices and electricity bills can be reduced since the soil has a high increase in temperature fluctuations. Of course, in any project, cost is always an issue. The lower the cost, the more attractive the project is to residents. With 1 bag of sawdust being only about 6.00, it can be quite a complete collection to replace the lost land. The only disadvantage of using sawdust as a good aggregate in the mixture is its weakness, which is water. Experiments and data analysis show that the surface saturation of water deposits and sawdust particles during the treatment makes it depressed, making it softer than it was designed, thus explains what happened in the water and splashed sample appears weak. This is due to the amount of solvent, suggesting that the sawdust-cement-gravel mixture should be used only in the interior of the house that cannot be reached by natural resources. Although it can absorb water in spurts, applying it will not be very good[11].

5.2 Limitations and Recommendations for Future Works

Some future recommendations for the work in this field are given below:

1. If we want to do more research about Sawdust Concrete in the future, we can use another sawdust instead of Segun sawdust in cement.
2. If we did a 10% sawdust test, we might have found another functional value
3. We also have to do tensile strength test of concrete.

REFERENCES

[1] Abdullahi A., Abubakar M. and Afolayan A., "Partial Replacement of Sand with Sawdust in Concrete Production", Concrete Technology: A.M. Neville, J.J. Brooks (Pearson Publications) 3rd Biennial Engineering Conference, Federal University of Technology, Minna, May 2013.

[2] Oyedepo O. J., Daniel S., Sunmbo O. and Akande P., "Investigation of Properties of Concrete Using Sawdust as Partial Replacement for Sand", Civil and Environmental Research, Vol. 6, No. 2, pp. 35–42, 2014.

[3] Narayanan A., Hemnath G., Sampaul K. and Mary A., "Replacement of Fine Aggregate with Sawdust", International Journal of Advanced Research in Basic Engineering Sciences and Technology, Vol. 3 (Special Issue), 2017.

[4] Velmurugan P. J. and, Jose R. B., "Effect on Strength Properties of M30 Grade of Concrete by Using Waste Wood Powder as Partial Re-placement of Sand", International Journal of Engineering Management and Research, Vol. 7, No. 2, pp. 301–305, 2017.

[5] Dixson J. P., Karthikeyan S. and Manikandan G., "Experimental Study on Properties of Concrete by Partial Replacement of Cement with Silica Powder and Fine Aggregate with Saw Dust Ash", International Journal of Civil Engineering and Technology, Vol. 8, No. 3, 2017.

[6] Ghosh B., "Experimental Investigation on the Feasibility of Using Sawdust as Partial Re-placement of Fine Aggregate in Concrete", School of Civil Engineering KALINGA Institute of Industrial Technology, 751024 April 2018.

[7] Geeta H. K., Prabhu L., Shrivatsa J., Sowmya D. and Ganesha S. R., "Experimental Study on Partial Replacement of Fine Aggregate with Quarry Dust and Saw Dust", International Re-search Journal of Engineering and Technology, Vol. 5, No. 5, pp. 2349–3224, 2018.

[8] Sawant A., Sharma A., Rahate R., Mayekar N. and Ghadge M. D., "Partial Replacement of Sand with Sawdust in Concrete", International Research Journal of Engineering and Technolo-gy Vol. 5, No. 3, Mar-2018.

[9] Suliman N. H., Razak A. A. A., Mansoor H., Alisibramulisi A. and Amin N. M., "Concrete using Sawdust as Partial Replacement of Sand: Is it Stronger and does not Endanger Health", MATEC Web of Conference, Vol. 258, No. 3, pp. 01015, 2019.

[10] Mangi S. A., Norwati J. and Wan I. M.H, Mohammad N. and Sohu S., "Utilization of Sawdust Ash as Cement Replacement for the Concrete Production", Engineering Science and Technology International Research Journal, Vol. 1, No. 3, pp. 11–15, 2017.

[11] Malik M. I., Syed R. J., Peer J. A and Syed A. N., Mohammad K.F., "Partial Replacement of Cement by Saw Dust Ash in Concrete A Sustainable Approach", International Journal of Re-search and Development, Vol. 11, No. 2, pp. 48–53, 2015.