International Journal of Innovative Science and Modern Engineering (IJISME)
ISSN: 2319-6386 (Online), Volume-7 Issue-2, March 2021

Experimental Analysis of Pond Ash on the Property of C-25 Concrete

A. Paulmakesh, Gizachew Markos Makebo

Abstract*: Due to high material consumption, infrastructure construction is rapidly becoming a serious problem in this world, particularly in developing countries. Concrete is produced in greater amounts, as a result of this aggregate shortage The focus of this research was to see if ash can substitute for fine aggregates in concrete The sample was collected from the Ayka Addis mill pond ash.The experimental laboratory of this research work was used to conduct tests on gradation, specific gravity, unit weight, moisture content, silt content, and water absorption, as well as workability, density, and compressive strength. The workability of each mix was measured before the concrete was cast, and the slum was 25 to 50mm. Furthermore, for accurate testing of density and compressive strength, cubes (150mm x 150mm x 150mm) of 7% to 30% pond and 5% to 30% of ash density, which were of concrete, were prepared. Up to 10% of the total mix, the concrete was found to have compressive strength of 34.75 N/sq.m.For this reason, fine aggregate at 10% replacement is the best aggregate to use.

Keywords: Compressive strength, Density, Pond ash and Workability

I. INTRODUCTION

In majority of the natural sand sources, rivers, the inorganic constituents chlorides, sulfates, silts, and clay are generally outweigh the amount of sand that can be removed by draining. Slowly hydration of concrete can be a result of the presence of any of these undesirable elements (biological and chemical) contaminants (e.g., lead, mercury, certain radionuclides, pyrite). Even more delicate aggregates, such as river silt, are sometimes used in concrete production. While there are numerous construction-related materials in the world, concrete is the most widely used of them all. Aggregateless of how fine or how coarse or how much it is mixed, it is always consists of liquid aggregate, dry aggregate, and powder aggregate The total volume of fine and coarse aggregate is greater than the percentage of fine, which means that most of the concrete is of the total volume. A refined aggregate is one of the main components of concrete, making up approximately 35% of the total used in construction.Excessive silt and clayey content, as well as organic impurities, all have a negative impact on concrete quality (Ngugi, et al., 2014).

II. STATEMENT OF THE PROBLEM

One of the most important uses of natural sand is in concrete production of concrete. Natural sand is highly demanded in these developing countries to meet the increasing infrastructure needs (Naheem, 2014). Finem river sand is in the production of concrete demand in construction industries. This has upset the river ecosystem by robbing the sand of its natural supply of nutrients, which has lead to sand depletion. In order to minimize resource consumption, it was imperative to discover new alternatives for the creative design of sustainable development. With this discovery, they utilized non-renewable resources like industrial byproducts in place of renewable resources (Rafieizonooz, 2017).

Manuscript received on March 03, 2021.
Revised Manuscript received on March 26, 2021.
Manuscript published on March 30, 2021.
***** Correspondence Author
Dr. A.Paulmakesh,* Department of Civil Engineering, Wolaita sodo university, Ethiopia. Email:paulmakesh1986@gmail.com
Gizachew Mar.os Makebo, Department of Civil Engineering, Wolaita sodo university, Ethiopia. Email:gizemark2009@gmail.com

III. SPECIFIC OBJECTIVE

- To learn the nature of pond ash
- To find out if pond ash interferesseess with fresh concrete
- To evaluate the impact of pond ash on the density and strength of concrete

To figure out the best percentage of pond ash for aggregate in concrete production

IV. SIGNIFICANCE OF THE STUDY

The increased construction activity in the country these days causes depletion of most concrete-making materials, particularly fine aggregate. On the other hand, coal combustion residue released from thermal power plants and disposed of as land fill has become a serious environmental issue. As a result, the findings of this study will be useful to a variety of stakeholders as a source of information for the use of industrial waste as an alternative material for building construction projects in order to reduce the depletion of natural sand for concrete production and its environmental impact through proper waste utilization. Furthermore, other researchers will use the study's findings as a reference for future research on eco-friendly alternative concrete construction materials.

V. LITERATURE REIVEW

Concrete is produced by mixing of fine and coarser components, which make up approximately 70% of the total concrete volume. Around a quarter of the total volume of concrete is constituted by fine aggregates. However, such a large amount of concrete consumption has strained over recent decades the natural sources of raw materials procurement (Anshuman, et al., 2016). Natural resources are constantly depleted worldwide, while waste produced by the industry is increasing significantly. Application of non-conventional and advanced materials as well as recycling waste materials to offset shortages of natural resources and the discovery of alternative environmental conservation methods are included in the sustainable development of construction.

The use of existing industrial waste materials for the fine aggregate of concrete can be considered in order to reduce use of river sand as a natural fine aggregate.

VI. CONCRETE MAKING MATERIALS

A. Cement

Portland cements are used primarily for their adhesive features and stable in aqueous environments. Adequate strength and durability for general use was provided for most cement. The use of general purpose cement which can be easily obtained locally is usually satisfactory and advisable.

B. Aggregate

In concrete, aggregates are an important component. The aggregate accounts for 70-80% of the volume of concrete. Detail studies on aggregate are required to understand their widely varying effect and influence on concrete properties such as compressive strength, workability, and density, among others. The grading curves are thoroughly examined in order to understand the behavior of coarse and fine aggregate as concrete properties (Chirag P. P., 2016). The use of a larger aggregate maximum size affects the strength in several ways.

C. Fine aggregate

Fine is the aggregate passing a sieve of 9.5 mm and passing a sieve of almost completely 4.75 mm (No. 4), with a seven (No. 200). (Chirag P. P., 2016).

Table- I: Fine aggregate grading limit (ASTM33-92a)

Sieve size	Percentage passing
9.5mm(3/8in)	100
4.75mm (No.4)	95-100
2.36mm (No.8)	80-100
1.18mm (No.16)	50-85
600µm (No.30)	25-60
300µm (No.50)	5-30
150µm (No.100)	2-10

Table- II: Limitation of finesse modulus as a guideline for different sand category (Denamo, 2005)

Category of sand	Fineness modulus (FM) limit of sand
Fine sand	2.2-2.6
Medium sand	2.6-2.9
Coarse sand	2.9-3.2

D. Coarse aggregate

The aggregate representing the fraction of materials kept at Sieve No.4 (4.75mm) is called a gross aggregate. In this experimental study the coarse compound used is 20mm, in angular form. Before using in concrete production, the aggregates should be free of any dust. E1-07(2007) can be obtained from natural or synthetic sources, according to the ACI 211.1-81 Education Bulletin.

Table-III: Properties of aggregate (ACI211.1-81 Education Bulletin E1-07, 2007

Property	Fine Aggregate	CoarseAggregate20 mm
Fineness Modulus	2 - 3.3	6 – 8
Specific Gravity	2.38	2.76
Water Absorption	< 4%	< 0.5%
Moisture content	0% - 10%	0% - 2%

E. Water

In the production of concrete, water is an important ingredient. Water has two functions in concrete mixtures: first, the reactions to the cement that will then finally be placed and hardened, and, second, the lubrication of all other materials and the workability of the concrete.

F. Pond ash

This study was attempted to find a solution by using concrete pond ash materials. There have been several consequences of the use of pond ash in concrete, such as reducing ash waste production (PA). Due to the use of coal as energy from a large number of thermal power plants, pond ash generated is dumped into the waste site.

Table -IV: Physical properties of pond ash

SI No.	Properties	Value
1.	Specific gravity	2.4
2.	Water absorption	15%
3.	Fineness modulus	2.79

Table -V : Chemical properties of pond ash

Compounds	% composition
Iron oxide (Fe_2O_3)	7.43
Aluminum oxide (Al_2O_3)	3.76
Sodium oxide (Na_2O)	1.42
Silicon dioxide (Si_2O)	81.37
Magnesium oxide (MgO)	1.44
Sulphur trioxide (SO_3)	0.69
Loss of ignition (LOI)	1.41
Potassium oxide(k_2O)	2.19

VII. RESEARCH METHODOLOGY AND MATERIALS

A. Research Design

Researchers focused on the characteristics of concrete and concrete workability, density and compressive strength mainly, but also pond ash In this study, the slum test for concrete and compressive strength measured by the use of a compression test engine at 7, 14 and 28 days was used to determine the operability of concrete and compressive strength of C-25 concrete.

B. Sample size and sampling Collection Technique

In order to carry out this study, we need to know how many standard and how many specifications to expect. As defined by the American Society for Testing and Materials and ACI practice, three 150 mm x 150 mm cub samples are required for each ASTM and ACI test of concrete strength

Table- VI: Sample size

Mix code	% of PA	Age of days			Total
		7	14	28	
PA0	0	3	3	3	9
PA5	5	3	3	3	9
PA10	10	3	3	3	9
PA15	15	3	3	3	9
PA20	20	3	3	3	9
PA25	25	3	3	3	9
PA30	30	3	3	3	9
Total		21	21	21	**63**

C. Sieve Analysis of fine aggregate

It is used to determine the index coarseness modulus of aggregates as well as the fineness modulus on the index. An aggregate having a fineness range of 2.3 to 3.1 is acceptable.

Retrieval Number:100.1/ijisme.B1281037221
DOI:10.35940/ijisme.B1281.037221
Journal Website: www.ijisme.org

Published By:
Blue Eyes Intelligence Engineering and Sciences Publication

An aggregate that has a fineness of 2.3 to 3.1 is acceptable However, sand particle size can be rated in terms of a fineness modulus, ranging from coarse particles that have a modulus of 2.9 to 3.1 to fine particles that have a modulus of 2.6 or 2.3 to 2.6.

Table- VII: Sieve analysis test result and the standard requirement for fine aggregate

Sieve	Cumulative passing %	ASTM Limit	
		Lower	Upper
9.5mm (3/4 in)	100	100	100
4.75mm (No.4)	100	95	100
2.36mm (No.8)	87.70	80	100
1.18mm (No.16)	66.95	50	85
600(No.30)	33.75	25	60
300(No.50)	12.25	10	30
150(No.100)	4.25	2	10

VIII. PROPERTIES OF POND ASH

A. Silt content of pond ash

Pond ash content performed pursuant to ASTM C 117, and also a permissible limit, was checked in accordance with ES referenced in (Dinku, 2002) which is recommended for washing or rejecting pond ash when the silt content exceeds 6%. The results of this experiment show that the permitted silt content in the pond ash pond is under Ethiopian law.

B. Sieve Analysis

The testing of the water filtration sieve was conducted according to ASTM F136 Table 1 reports the sieve experiment on the pond ash 7.

Table - VIII Sieve analysis test result and the standard requirement for pond ash

Sieve	Cumulative passing %	ASTM Limit	
		Lower	Upper
9.5mm (3/4 in)	100	100	100
4.75mm (No.4)	100	95	100
2.36mm (No.8)	87.25	80	100
1.18mm(No.16)	67.00	50	85
600(No.30)	36.50	25	60
300(No.50)	14.00	10	30
150(No.100)	.	2	10
FM	2.90		

C. Moisture content of Pond ash

Similarly to fine aggregate, the moisture content of pond ash was determined using ASTM C 566-97 by oven drying a sample of pond ash (500gm) in an oven at 110 0c for 24 hours and dividing the weight difference by the oven-dry weight.

D. Unit weight of pond ash

Unit weight tests were done by filling and weighing a container of known volume in accordance with ASTM C 29. ASTM C 29 is the weight test. The unit weight of the aggregate is obtained by dividing the aggregate weight by the volume of the container. The material's unit weights are divided into three categories: light unit weight, normal unit weight, and heavy unit weight. The material's light unit weight is less than 1200 kg/m^3; the 1200 to 1760 kg/m^3, and anything above that is heavy unit weight (ACI318M, 2011).

E. The specific Gravity and Absorption Capacity of Pond ash

The specific gravitational and absorbent pond ash samples were determined by standard testing method under ASTM C128-93 (Re-approved 2001). As aggregates contain pores that are usually permeable and waterproof. The specific gravity of material classified as light, normal and high specific gravity, according to a concrete technology book. Light specific gravity is below 2.4, the normal special gravity of the aggregate material is below 2.4-2.9, and the specific heavy aggregate is above 2.9.

Table – IX: Chemical requirements (ASTM C618, 2012)

Compounds	Class" F"	Class "C"
Silicon dioxide (SiO_2) +Aluminum oxide (Al_2O_3) +Iron oxide (Fe_2O_3) minimum, %	70	50
Sulfur trioxide (SO_3), max, %	5	5
Calcium oxide (Cao)	-	>10
Na2O, max, %	1.5	1.5
Moisture content, max, %	3	3
Loss of ignition (LOI), %	6	6

Table 9 shows that the amount of IfO_2 + Al_2O_3 + Fe_2O_3 in pond ash is more than 70% by its chemical composition. The pond ash can therefore be classified as a F pozzolana in accordance with the ASTM C618. The ignition value was 6.13%, which was slightly higher than the demands and the moisture content value was within the 3% limit of the same standard. The pond ash used in this study therefore met the ASTM C 618 requirement.

F. Water

In this study water was employed to mix the concrete and cure the specimens from JIT of the water supply laboratory of civil engineering. The kind of water used was drinking water.

IX. RESULT

A. Physical Properties of pond ash

A sieve analytical test determined the particle size distribution of PA and the fine aggregate. Table 9 and Figures 1 and 2 below show the outcome of the sieve analysis of the PA and fine aggregates.

Table –X: Gradation test for pond ash and fine aggregate

Sieve Size[mm]	Pond Ash [2000g] Finer passing (%)	Fine aggregate[2000g] Finer passing (%)	ASTM Limit	
9.5	100	100	100	100
4.75	100	100	95	100
2.36	87.25	87.70	80	100
1.18	67.00	66.95	50	85
0.6	36.50	33.75	25	60
0.3	14.00	12.25	10	30
0.15	5.25	4.25	2	10

Retrieval Number:100.1/ijisme.B1281037221
DOI:10.35940/ijisme.B1281.037221
Journal Website: www.ijisme.org

Published By:
Blue Eyes Intelligence Engineering
and Sciences Publication

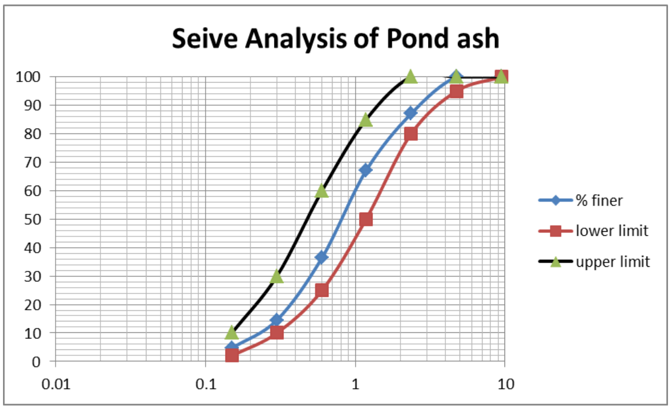


Fig.1. Particle size distribution for pond ash

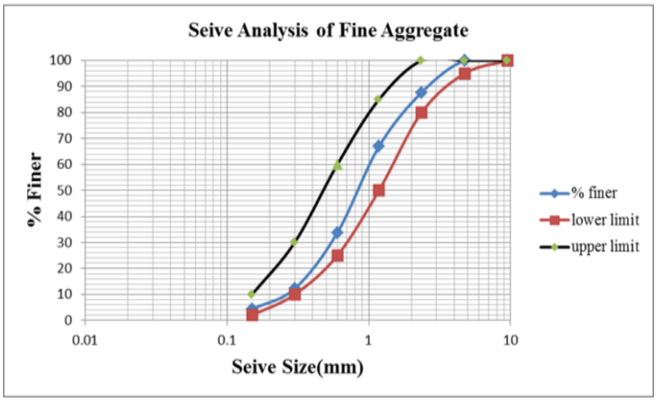


Fig.2. Particle size distribution for fine aggregate

Results above show that all pond ash particles and fine aggregations have passed through their 9.5 mm sieve size with the particle size analysis. This shows that both the pot ash and the fine aggregate are of particle size less than 9.5 mm. The particles from the sample of the pond ash passed through a size of 4,75mm and 2,36mm, are 100% and 87.25% as well as 100% fine-samples. Pond ash is more coarse than the fine aggregate from the result of a 4.75mm and 2.36mm sieve analysis. The particles, on the other hand, passed through 1.18mm, 0.6mm, 0.3mm and 0.15mm, at 67%, with 36.5%, 14% and 5.25% for pond ash, were 66.95%, 33.70%, 12.25%, 4.25%, and 4.25% for fine total ash. The results from the analyzes of 1.18mm, 0.6mm, 0.3mm and 0.15mm show that the lake ash is finer than the fine aggregate. The results for analysis of pond ash 4.75mm, 2.36mm, 1.18mm, 0.6mm, 0.3mm and 0.15mm are coarsest to higher screen size and finer to less than the fine sized aggregate, respectively. Furthermore, the ASTM requirements of both PA and FA have been met.

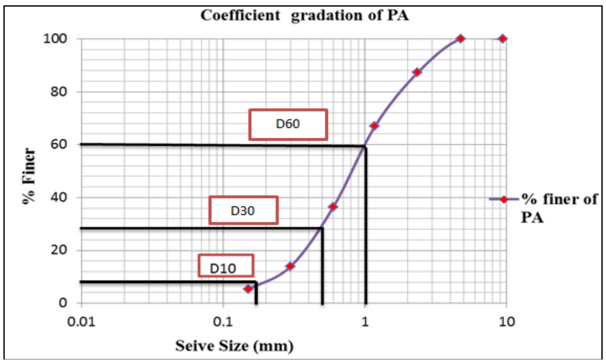


Fig.2. Grading curve for pond ash

To figure out the percentages passing the test of uniformity (60%, 30%) and coefficient of curvature (10%, which are found by D60, D30), and finally to compare these numbers to determine whether the material is well graded or poorly graded. The result of this figure shows that, respectively, 1.00, 0.5 and 0.2mm are graded with pond ash D60, D30 and D10 which pass through sieved sizes. The Cu values between the range of 1-3(1<cc<3) or higher than 5(Cu >5) and CC values are defined in the ASTM C32-82 when the materials are well graded. The pond ash value of Cu was therefore found to be higher than the standard specified. The CC value was 1.25 between the ranges of the same standards. The CC value was found. As shown above, the pond ash was classified as a well classified ASTM material.

Table- 10: Effect of pond ash on the workability of fresh concrete

Sr.No	Mix Code	Replacement percentage (%)	Observed slump value	W/C
1	PA_0	0	30	0.509
2	PA_5	5	28	0.509
3	PA_{10}	10	25	0.509
4	PA_{15}	15	20	0.509
5	PA_{20}	20	18	0.509
6	PA_{25}	25	11	0.509
7	PA_{30}	30	6	0.509

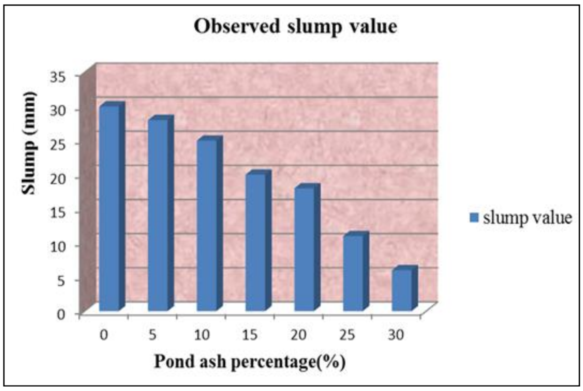


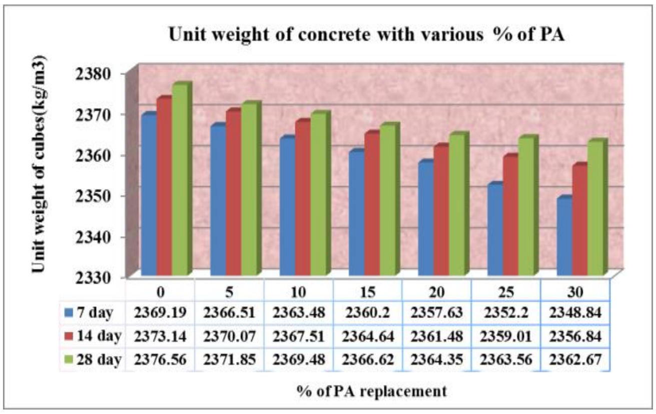
Fig. 4. Workability of concrete with increasing PA replacement

Based on the above table and figure test results, it is clear that the slump value of pond ash-containing concrete decreases slightly as the pond ash content increases. As a result, the slump value of fresh concrete became less workable at 0%, 5%, 10%, 15%, 20%, 25%, and 30% pond ash, with values of 30mm, 28mm, 25mm, 20mm, 18mm, 11, mm, and 6mm, respectively. As shown in figure 4, the pond ash content was inversely proportional to the workability of fresh concrete mixes. Slump value was observed when pond ash content exceeded 10% replacement by fine aggregate in all concrete batches, resulting in low workability.According to Kumar, the 0% , 10% and 30% concrete workability results were 35 mm, 20 mm, 15 mm, and 10 mm. The more pond ash is used, the less workable the concrete becomes. Because PA is finer than natural sand, it is less workable. Since there is more fine aggregate, less lubrication is required. Shekhar et al. conducted experimental studies on the use of pond ash.

The concrete's workability degrades as the pond's water content increases.Pond ash was used to increase the weight of coarse aggregate in the production of concrete cubes in this experiment.
In the same manner as it was described compression testing revealed a 7-day, 14-day, and 28-day weighted average Figure 5 shows the density for this range of ages.

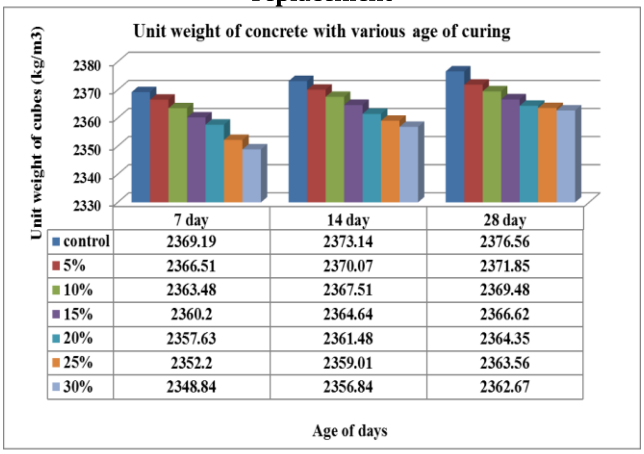
B. Effect of pond ash on the Unit weight of harden concrete

PA was used to replace fine aggregate in the production of concrete cubes in this study. The specimens were prepared in the same manner as described in section. The specimens were weighed at 7, 14, and 28 days before compressive strength testing. The density of the specimens at these ages is shown in figure 5 below.



	0	5	10	15	20	25	30
7 day	2369.19	2366.51	2363.48	2360.2	2357.63	2352.2	2348.84
14 day	2373.14	2370.07	2367.51	2364.64	2361.48	2359.01	2356.84
28 day	2376.56	2371.85	2369.48	2366.62	2364.35	2363.56	2362.67

Fig. 5. Unit weight of concrete with increasing PA replacement



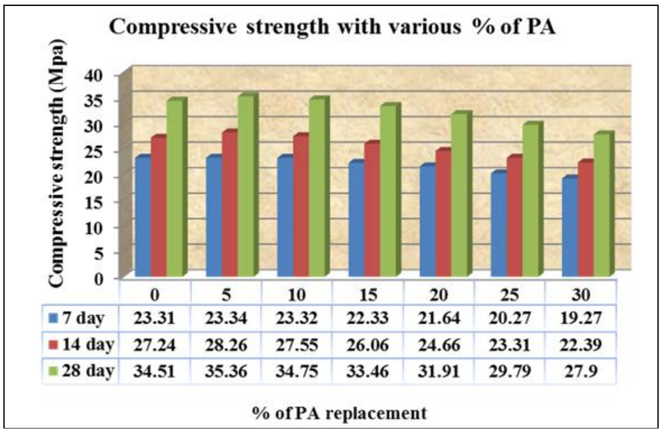
	7 day	14 day	28 day
control	2369.19	2373.14	2376.56
5%	2366.51	2370.07	2371.85
10%	2363.48	2367.51	2369.48
15%	2360.2	2364.64	2366.62
20%	2357.63	2361.48	2364.35
25%	2352.2	2359.01	2363.56
30%	2348.84	2356.84	2362.67

Fig.6. Average unit weight of concrete with increasing curing age

The density of concrete specimens decreases as the percentage content of pond ash increases, as shown in figure 6. Furthermore, the results of figure 4.8 show that the density of concrete specimens increases with increasing curing ages at the 7th, 14th, and 28th days, respectively. According to Nurzal et al. (2018), the longer the drying time, the higher the density, due to the chemical reaction between cement and water, this causes the concrete to harden after a while and increases water absorption. The density value increased with drying time on the 7th, 14th, and 28th days, reaching its maximum density value on the 28th day. According to Kalgal et al. (2007), the average density of concrete with sand as fine aggregate is slightly lower than the normal concrete density. This density decrease is due to the lower specific gravity of pond ash.According to Prashant Kumar Sharma et al. (2018), the lower bulk density and specific gravity of pond ash when compared to fine aggregate causes a decrease in concrete unit density.

C. Effect of pond ash on the compressive strength of harden concrete

Although the two most frequently used concrete strength tests, the compression test and the rebound test, produce the same results, they are sufficient for testing and improving the overall performance of hardened concrete, the rebound capacity of hardened concrete is only sufficient to do the first. This property holds true for concrete when it is compared to other tests, but not for many other design standards, as this is dependent on the concrete's own strength alone. The figure shows the progress of a compressive strength test in figure 7.



	0	5	10	15	20	25	30
7 day	23.31	23.34	23.32	22.33	21.64	20.27	19.27
14 day	27.24	28.26	27.55	26.06	24.66	23.31	22.39
28 day	34.51	35.36	34.75	33.46	31.91	29.79	27.9

Fig. 7. Average compressive strength with increasing PA replacement

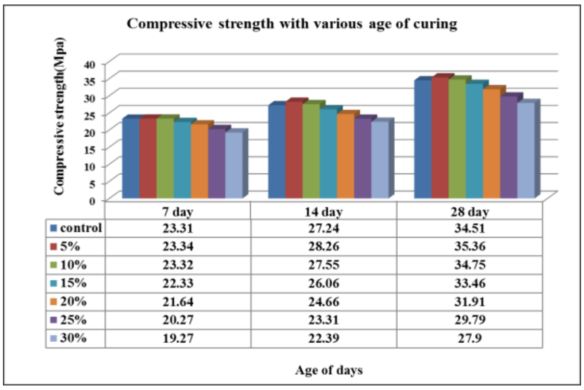
It appears in the table and the figure above that the compressive strength decreases as the percentage of the cementing material in the mix decreases. Compressive strength in the control samples at 7, 14, and 28 days after compacting: 0.74 percent increased, 2.46 percent, and 0.11 percent in comparison to the samples before compacting, respectively; the advanced ones increased from 7 to 14 and 28 days after compacting by 0.04, 0.44, 2.46, and 0.10 percent. Reducing the compressive strength of the pond ash concrete samples from their initial values by 4.2%, by 3.4%, 7.4%, 7.5%, 13.4%, and 14.4%, they expanded by 4.3%, 7.8%, and 8.5% respectively.When pond ash was introduced to 20% fine aggregate replacement was evaluated, it increased compressive strength at all ages.

Compressive strength increased to a higher level, and on the other hand, it peaked at approximately 15% of normal capacity. , 27, 56, and 1.6% higher than the baseline concreteas well as Pond sediments (SHEK-mah-hat, 2015) in concrete and concrete mix as well as ShekHar and his colleagues (2017) conducted their research on sediments and carried out a study on Pond ash.
Pond ash was contrasted with normal sand and was seen to have similar properties 10% as a higher b as an equivalent to pond algerite replacement, 20% as higher than pond algerite, 30% as superior to pond-algerite, 40% as comparable to the peat content, and 50% as high as organic material,

Retrieval Number:100.1/ijisme.B1281037221
DOI:10.35940/ijisme.B1281.037221
Journal Website: www.ijisme.org

Published By:
Blue Eyes Intelligence Engineering
and Sciences Publication

and 60% as close to new in place of the number of pre-aggregate generation replacement Compressive strength concrete (at ten percent Pond ash), 42 and 55 percent of the original volume are reinforced after twenty-eight days. (After fourteen days, the concrete is more powerful; after twenty, the reinforcement is stronger; and, though, after a length of time, it is also.)



	7 day	14 day	28 day
control	23.31	27.24	34.51
5%	23.34	28.26	35.36
10%	23.32	27.55	34.75
15%	22.33	26.06	33.46
20%	21.64	24.66	31.91
25%	20.27	23.31	29.79
30%	19.27	22.39	27.9

Fig 8: Average compressive strength with increasing age of curing

The figure above shows that in concrete production, the compressive strength has been decreased by the percentage value of pond ash, but the compressive strength has risen in the age of curation.

X. CONCLUSIONS

The following points can be concluded from the research carried out on the effect of pond ash on the properties of concrete C-25 by the test results: The results show a lower species gravity, a lower mass density, light weight and a somewhat high absorption of water than that of fine aggregate, compared with the Ayika Addis Textile pond ash. The results obtained showed good results in terms of workability of up to 10 percent of the replacement concrete of the pond ash, but beyond that the slump value of the concrete decreases with the increased content of the pond ash. According to the results of the test observed, the unit weight of the concrete sample contained in the pond showed a slight reduction in PA content, as the PA content increases as a consequence of the lower specific gravity of the pond ash as compared to that of the fine aggregate. The compressive strength of 5% and 10% of pond ash concrete in relation to the control concrete improved at 7, 14 and 28 days, respectively, compared to the test results. Conversely, the pond ashes containing 15%, 20%, 25% and 30% reduced the compressive strength respectively by 7, 14 and 28 days compared to the control concrete. In this study, a compressive strength of 34.75 N/mm^2 was obtained at a maximum replaced finest by pool ash at 10 percent.

REFERENCES

1. ACI 116R-00 Cement and concrete terminology.
2. ACI Education Bulletin E1-07 (2007), "Aggregates for Concrete", Developed by ACI Committee E-701. 2-5.
3. Anshuman, T., Sarbjeet, S and Ravindra, N. (2016). Feasibility Assessment for PartialReplacement of fine Aggregate to Attain Cleaner Production Perspective inConcrete. Journal of Cleaner Production. 15(4).
4. Arachchige, M. (2008). Influence of cement content on corrosion resistance. Construction Materials, Institution of Civil Engineers. 161: 31–39.
5. Arumugam, K. Ilangovan, R. James M. D. (2011). A Study on Characterization and use of Pond Ash as Fine aggregate in Concrete. International Journal of Civil and Structural Engineering. 2 (2): 466-474.
6. Bhor, S . Dhomase, V. Kale, C. and Varhadi, S. (2017). A Review paper on partial replacement of fine aggregate by pond ash. International Journal of Engineering Sciences and Management.
7. C. Gonilho Pereira, J. Castro-Gomes, L. P. de Oliveira (2009). Influence of natural coarse aggregate size, mineralogy and water content on the permeability of structural concrete, Construction and Building Materials. 23(2): 602–608.
8. Chirag, P., Palak, S and Abhyuday, T. (2016). Gradation of Aggregates and Its Effects on Properties of Concrete. International Journal of Trend on Research and Development. 3(2): 2394-9333.
9. Chun ,L., Bong, K., Jin, S., Kim, T., Sang and ChaeSeong, T. (2008). A study on the fundamental properties of concrete incorporating pond-ash in korea. International Conference. 401-408.
10. 10.Sharma, P.K., Himani and Dabas,V. (2018). Experimental study with pond ash as partial replacement of fine aggregate in concrete with super plasticizer. International Journal of Research in Engineering and Technology. 7 (7).
11. Shewaferaw. (2006). The Use of Manufactured Sand in Concrete Production: TestResult and Cost Comparison, Addis Ababa University.
12. Taylor, W.H. (2000) .Concrete Technology and practice. 4th ed.
13. Tomas, U. and Ganiron, Jr. (2014). Effect of Sawdust as Fine Aggregate in Concrete Mixture for Building Construction. International Journal of Advanced Science and Technology. 63: 73-82.
14. Tumingan, M.W. (2014). Compression strength of concrete with pond ash.Journal of Engineering and Applied Sciences. 9(12).
15. Tushar, G., M, P. B. (2015). A Study on Concrete Properties by Partial Replacement of Sand by pond ash.Wassermann, R, Katz, A., and Bentur, A.(2009). Minimum cement content requirements: Materials and Structures. 42: 973–982.
16. Wilby, C. (1991). Concrete materials and structures. Cambridge University press

AUTHORS PROFILE

Dr.A.Paulmakesh, has working as an Associate Professor,college of engineering in the department of civil engineering at wolaita sodo university, Ethiopia. He has done Ph.D in Dr.M.G.R university n the year 2019. He has complected master of technology in the year of 2011.He has teaching experience of over 10 years. He has published more then 40 research artcle papers in which contains scopus indexed journal, peer reviewing journal conference. And also paper presented in national and international conference. He has involved in research work such as structural steel, materials of concrete etc., He has well versed knowledge in civil engineering designing software's and construction management software's. He has a professional membership in the Institutions of Engineers (India) – Charted Engineer, MIE, Charted valuer and Registered Construction Engineer in CMDA.He has fellow member of International Institute of Organization Research. He have been selected for the most prestigious international Research Award 2020-21, instituted by the International Institute of Organization Research (I20R).

Gizachew Markos Makebo, has working as a head,department of civil engineering,college of engineering at wolaita sodo university, Ethiopia. He has completedB.Sc in civil engineering in the year of2004(E.C).He has sucessfully done M.Sc in Construction Engineering and Management in the year of 2011(E.C). He has published research article more than ten papers. He has doing thesis adviser, coordinators and committee members for B.Sc and M.Sc, Civil Engineering students. He has involved in research work such as materials of concrete, geotechnical investigations etc., He has well versed subject and practical knowledge such as structural designing, construction management etc., He has sound ability to ensure full project compliance with applicable rules and regulations. And also he is strong multitasker with exceptional skill in functioning well in a high-pressure work environment.

Retrieval Number:100.1/ijisme.B1281037221
DOI:10.35940/ijisme.B1281.037221
Journal Website: www.ijisme.org

Published By:
Blue Eyes Intelligence Engineering and Sciences Publication