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A EXPERIMENTAL STUDY ON BOTH CEMENT AND FINE AGGREGATE BY PARTIAL REPLACEMENT WITH POND ASH

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Abstract - This paper presents on a experimental study on cement and fine aggregate by partial replaceme nt with pond ash. The amount of coal ash waste produced in a thermal power plant in vijayawada is huge amount of pond ash can be produced . Improper disposal of pond ash will effect the ground water table an d effect environmental problems like air pollution and ground pollution. By these conditions,during this st udy we tend to attempt notice an answer by utilizing pond ash material for concrete producing. The dispos al of pond ash used in wet method and also used in land fill. In cement 20% fly ash used in concrete, so we were presented cement is partial replacement with pond ash in project starts with 20%,25%,30%,35%,40% . The optimum usage of pond ash used in concrete and check the properties of fresh concrete and compare with conventional concrete by compressive strength test and workability.

In this study pond ash partial replaced in both cement and fine aggregate in 10%, 15%, 20%. This study is to save the natural resources and reuse of pond ash in construction activity and decrease the disposal prob lem of pond ash. Pond ash contain two types of ashes they are bottom ash and fly ash. As compared to con ventional concrete the strength has been increased 25% by adding 30% of pond ask in cement, fine aggreg ate and cement replaced with pond ash with 10%, increases 30% of strength as compared to the conventio nal concrete strength.

Key words –pond ash, fly ash bottom ash , land fill, compressive strength, workability, natural resources, w et method.

Study on- 1.Cement partial replacement with pond ash
2.Cement and fine aggregate both are partial replacement with pond ash.

1. INTRODUCTION

In India, most of the Thermal power plants adopt wet method of ash disposal. Pond ash is collected from Thermal power plant at the bottom. Pond ash utilization helps to reduce the consumption of natural resources. Also it is help to solve th e problem of disposal of Pond ash because it contains huge amount of chemical compounds such as SiO_2, Al_2O_3 etc. The se chemical compounds (SiO_2, Al_2O_3) are plays an important role in hydration reaction and helps to produce bond betwe en two adjacent particles. Use of Pond Ash in concrete is an important eco efficiency drive.

Continuous research efforts have proved concrete as a versatile material. Concrete needed for a wide range of constructi on activity can be made easily available since all the constituents of concrete are of geological origin.If proper replacem ent level and procedure is used then pond ash concrete may be used for highway embankments, mass concreting, Plain C ement Concreting (PCC), etc.

Since construct any infrastructure the required cement cost will be high. Pond ash defined as a residue and by-product o f thermal power plants can be an inexpensive alternative to the cement. The un-utilised electro static precipitator ash and bottom ash are mixed in slurry form and taken to lagoons for deposition which are known as pond ash.

The amount of coal ash waste produced in a thermal power plant in vijayawada is very high and dumped in a m ixed state between fly ash and bottom ash. The coal ash waste is not well managed because the sites between the product ion and disposal process of power plant are not separated, so it accumulates and requires a larger final disposal area.

2. MATERIALS USED

Cement

Cement used this study was KCP brand ordinary portland cement of grade 43.The cement was kept in an airtight contai ner and sorted in the humidity controlled room to prevent cement from being exposed to moisture, which conforming to IS 12269:1987have been procured and following tests have been carried out according to the IS:8112-1989.

Physical Properties of Cement

Property	Result
Specific gravity	3.1
Fineness	4%
Normal consistency	32%
Initial and final setting time	32 and 245 minutes

Coarse Aggregates:

Locally available graded aggregate of maximum size of 12.4 mm is used for our present investigations. Testing of coarse aggregate was done as per IS: 383-1970.The 12.4 mm aggregates used were first sieved through 12.4 mm sieve and the retained on 4.74mm sieve. They were then washed to remove impurities such as dust, clay particles and organic matters t hereby dried to surface at dry condition. The coarse aggregate is also tested for its various properties by using IS:2386-1 963.

Physical Properties of Coarse Aggregates

Property	**Result**
Specific gravity	2.78
Fineness modulus	2.27
Bulk density (loose)	1449 kg/m^3
Bulk density(compacted)	1716kg/m^3

Fine Aggregate:

The sand used for experimental program me was locally procured and conformed to grading zone III as per IS:383-1970 .the sand first sieved through 4.74 mm sieve to remove any particles greater than 4.74 mm and was washed to remove du st. The sand is tested in accordance with IS 2386-1963.

Physical Properties of Fine Aggregate

Property	**Result**
Specific gravity	2.65
Fineness modulus	3.02

Pond Ash:

Pond ash is a non-plastic and lightweight material having a specific gravity relatively lower than that of a similar graded conventional earth material. It is a mixture of fly ash and bottom ash that is sluiced to large storage ponds. Fly ash is a fi ne-coarse, glass powder recovered from the gases of burning coal during the production of electricity. These micron size dearth elements consist primarily of silica, alumina andiron. Massive generation of ash by thermal power plants has bec ome a major cause of concern for people living in and around thermal power plants. The basic and essential parameters of pond ash, to be used in geotechnical constructions, are the compaction characteristics, strength properties and consoli dation parameters.

To develop the conventional concrete of grade M20, and investigates the influence of the use of Pond ash as a replaceme nt for natural fine aggregate and cement on the physical properties of concrete in the fresh and hardened state in compres sive strength and also on durability. Use of Pond Ash in concrete is an important eco efficiency drive to conserve natural resources of sand and cement. The pond ash used in concrete to reduce the heat of hydration.

Physical Properties of Pond ash

Property	Value
Specific gravity	2.65
Moisture content	1.366%
Colour	Light gray
Bulk density	830 Kg/m^3

Water:

Water is key ingredient, which when mixed with cement, forms a paste that blinds the aggregate together. There is not much limitations for water except that the water must not severely contaminated. In this study, normal tap water was use d.

Methodology:

The evaluation of pond ash for use as a partial replacement of cement and fine aggregate material begins with the concre te testing. The study and behaviour of compressive strength of concrete when the base materials, i.e. Cement and fine ag gregate is replaced with pond Ash respectively. Three samples per different proportions were tested with the average stre ngth values reported in this paper. The pond ash replacement with cement was kept at 20%, 25%, 30%, 35%, 40% by we ight of M 20 grade concrete. Similarly, pond ash replacement in both cement and fine aggregate was kept at 10%, 15%, 20%. In all total 27 cubes of OPC (150mm * 150mm *150mm) were examined and results were analyzed after 28 days. Information obtained from the replacement is compared with data from a Conventional concrete.

Mixing procedure:

The mixing procedures divided into three stages. In the first stage, all the binder (cement) were weighted accordingly an d mixed by hand until all the constituents mixed uniformly. This was make sure that all the binders were mixed thorough ly to produce a homogeneous mix. The second stage involves mixed in the binders with aggregates and for about five mi nutes. At the final stage, water was added into the concrete mix. The step was crucially important make sure that water was distributed evenly so that concrete we have similar water binder ratios for every specimen. After that concrete can b e placed in cubes as per recommended dimensions.

Tests on concrete:

- The fresh concrete can be conducted on workability test as : Slump cone test
- The hardened concrete can be conducted on test on Strength as : compression test

Slump cone test:

Workability is could be a term related to freshly ready concrete. This can be defined as the ease with which concrete can mixed, placed, compacted and finished. Slump check is that the most ordinarily used methodology of activity workabilit y of concrete in very laboratory . It is used conveniently as a control test and gives an indication of uniformity of concret e from batch to batch. Vertical settlement of a customer cone of freshly ready concrete is named slump.

Slump in mm (cement partial replaced with pond ash)

Representation mix	Water - Cement ratio	Cement partial replace ment with pond ash	Height of mol d H_1 (mm)	Height of subsi ded concrete H_2 (mm)	Slump (mm) (H_1-H_2)
A	0.5	0%	300	272	28
B	0.5	20%	300	270	30
C	0.5	25 %	300	260	40
D	0.5	30%	300	252	48
E	0.5	35%	300	250	50
F	0.5	40%	300		65

Slump in mm (Both Fine aggregate and cement partial replaced with pond ash)

Representation mix	Water - cement ratio	Cement and fine aggregate partial replacement with pond ash	Height of mold H_1 (mm)	Height of sub sided concrete H_2 (mm)	Slump (mm) (H_1-H_2)
G	0.5	10%	300	260	40
H	0.5	15%	300	252	48
I	0.5	20%	300	246	54

Compressive strength test:

Testing hardened concrete plays an important role in controlling and conforming the quality of cement concrete work. The main factor in favour of the use of concrete in structures is its compressive strength. One of the important properties of the hardened concrete is its strength which represents its ability to resist forces. The compressive strength of the concrete is considered to be the most important and is often taken as an index of the overall quality of concrete. The compressive strength of concrete is defined as the load which causes the failure of specimen per unit cross section on compression under given rate of loading.

Compression testing results (cement partial replaced with pond ash)

Representation mix	Water Cement ratio	cement partial replacement with pond ash	compressive strength of cubes at 7 days (N/mm^2)	compressive strength cubes at 14 days (N/mm^2)	compressive Strength cubes at 28 days (N/mm^2)
A	0.5	0%	16.68	19.6	24.1
B	0.5	20%	14.66	18.67	24.4
C	0.5	25 %	15.56	19.02	25.78
D	0.5	30%	17.78	20.4	30.2
E	0.5	35%	16	19.5	26.6
F	0.5	40%	10.67	14.58	20.4

Compression testing results(cement and fine aggregate both partial replacement with pond ash)

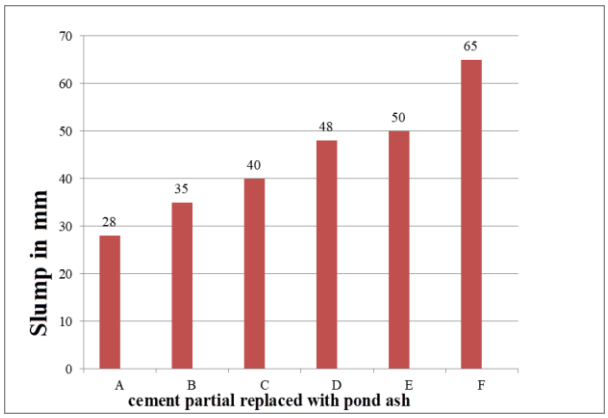
Representation mix	Water - cement ratio	Cement and fine aggregate partial replacement with pond ash	Compressive strength of cubes at 7 days (N/mm^2)	compressive strength of cubes at 14 days (N/mm^2)	compressive strength of cubes at 28days (N/mm^2)
G	0.5	10%	21.3	26.2	31.5
H	0.5	15%	18.6	22.2	27.0
I	0.5	20%	16.6	19.5	24.8

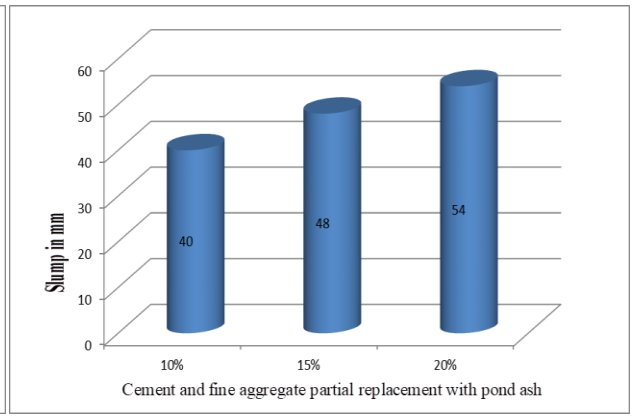
Results:

The results can be represented by bar charts

Slump in mm Slump in mm

(cement partial replaced with pond ash) (cement and fine aggregate partial replaced with pond ash)

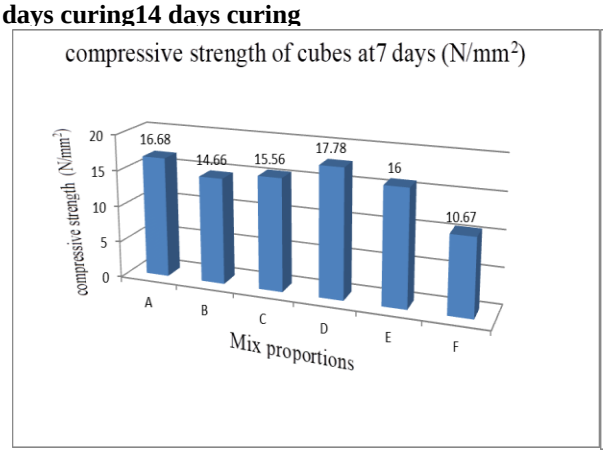


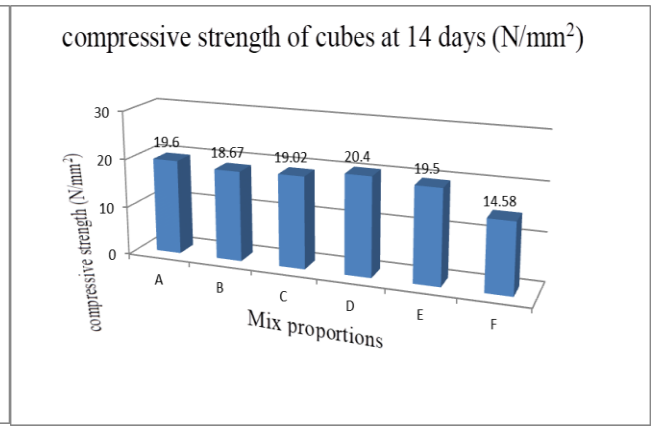


COMPRESSION TEST RESULTS

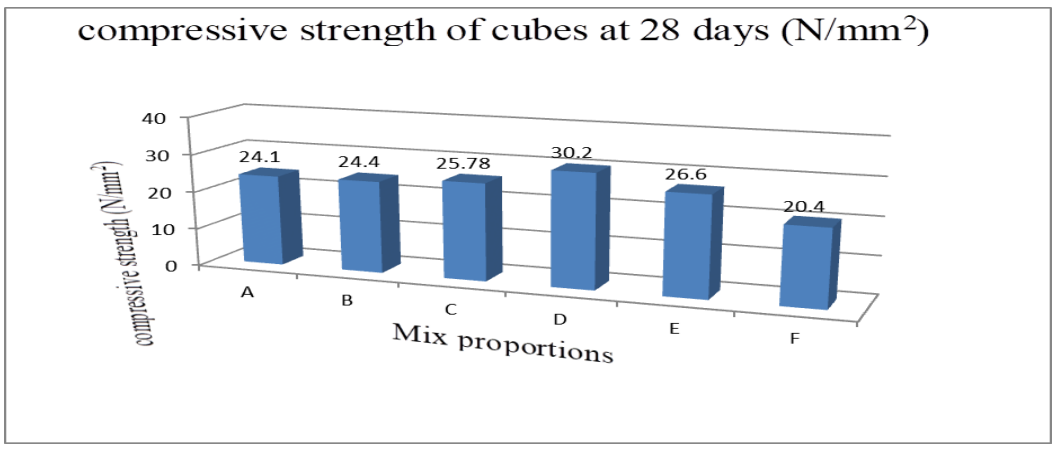
Cement replacement with pond ash

7 days curing14 days curing

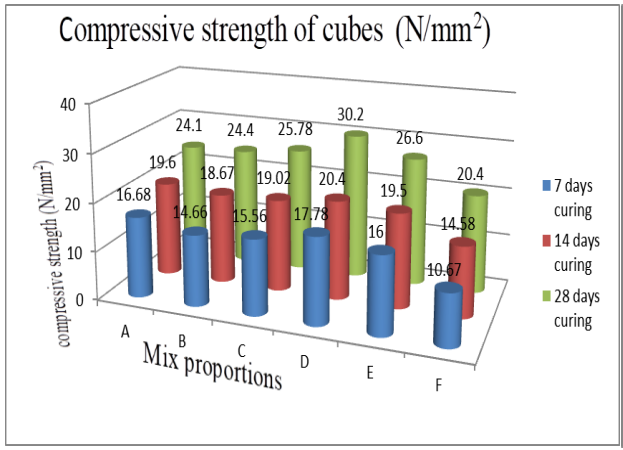


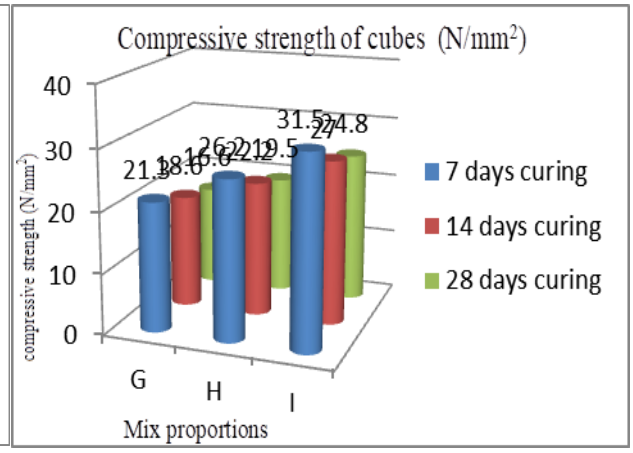


28 days curing



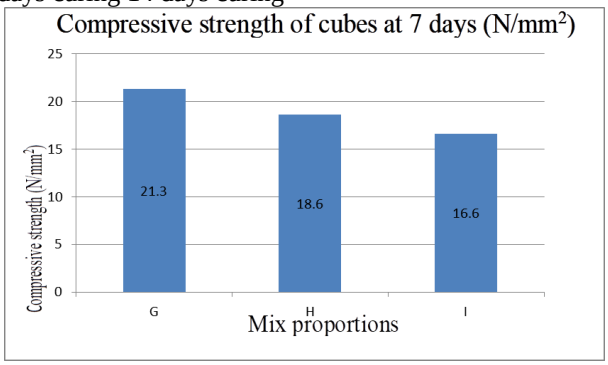
Cement replaced with pond ash cement and fine aggregate replaced with pond ash

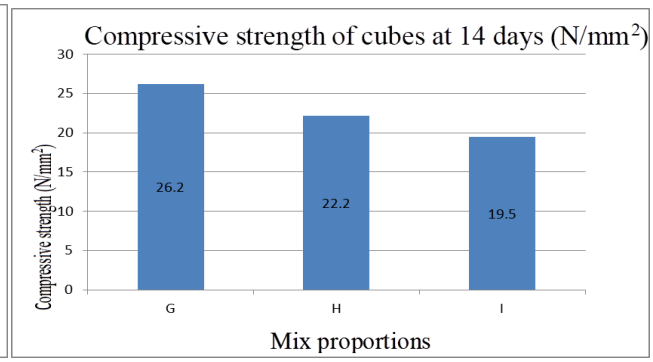




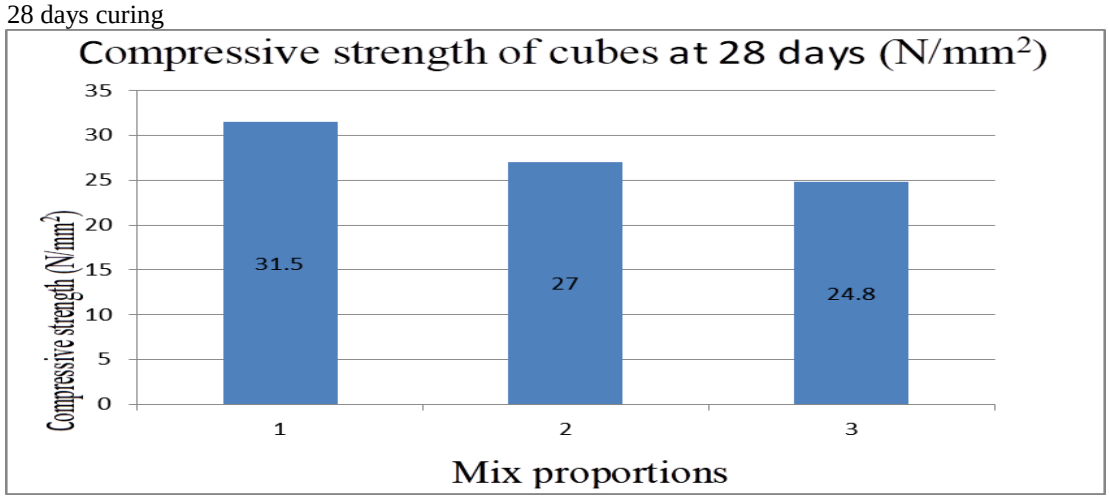
Cement and fine aggregate replaced with pond ash

7 days curing 14 days curing





28 days curing



Conclusion:

The above study two cases:

1. Cement partial replaced with pond ash
2. Cement and fine aggregate both are partial replaced with pond ash

Conclusion I : The cement can be partial replaced with pond ash by different percentage pond ash mixed in concrete mi x. Ultimately 30% pond ash is partial replaced in cement was given good results as compared to conventional concrete a nd other percentages pond ash mixed in concrete. As compared to conventional concrete the strength has been increased 25% by adding 30% of pond ask in cement.

Conclusion II : The Cement and fine aggregate both are partial replaced with pond ash by different percentage proporti on mixed in concrete. The finally in both fine aggregate and cement can be 10% partially replaced concrete satisfy the c onventional concrete as compared to other percentages pond ash.. Fine aggregate and cement replaced with pond ash wit h 10%, increases 30% of strength as compared to the conventional concrete strength.

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