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Partially replacement of sand with Pond ash

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Abstract*—In the thermal power plants, the coal is burnt to heat the water for making the steam, which in turn is used to run turbines. The pond ash is a waste product from the boilers. It is mainly obtained from the wet disposal of fly ash, which when get mixed with bottom ash is disposed of in large pond. The pond ash is generated in an alarming rate. The generation of pond ash is posing a lot of threat to environment and thus its sustainable management has become the thrust area in engineering research. Pond ash is to be investigated for its use as a partial replacement of sand. The effort is to be made for utilization of pond ash as sand replacement material in mortar which may introduces many benefits from economic and environmental point of view. The sand is partially replaced by pond ash as 10%,15% ,20%and 25%. The strength property of mortar with pond ash for strength at 7, 14 and 28 days as partial replacement by sand.*

I. INTRODUCTION

1.1 Overview of Partially Replacement of Sand with Pond Ash

Concrete is a construction material composed mainly of Cement, Fine Aggregate (Sand), Coarse Aggregate, Water and Admixture. River sand is the most commonly used Fine aggregate in many parts of the world. The huge demand for concrete has made this natural resource to get impoverished. On one side extraction of river sand in excess has conspicuous environmental impacts, on the other side, large quantity of coal ash is being produced every day in Thermal Power Plants, leading to many environmental problems. It is of prime importance to carry out research works on the feasibility of using alternative materials like Pond Ash, a waste by product and its suitability for potential utilization in concrete constructions, which can replace sand partially or fully as an alternative construction material contributing to sustainability and reducing burden on environment. Concrete is the most used construction material across the world and in concrete maximum part is Fine aggregate. Hence, if pond ash used as at least partial replace with fine aggregate than it will reduce cost of concrete production.

Pond ash are needed from the view of point of experimental preservation and effective utilization of resources. However, information about pond ash using in concrete as fine aggregate with partial replace with pond ash is still insufficient so it will be an advisable to get more details about the characteristics of concrete using pond ash.

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1.2 Objective

1. To achieve economy
2. To do disposal of this waste product of thermal power plant, this study gives some ideas to utilization of pond ash.
3. To decrease the scarcity of natural sand due to heavy demand in growing construction activities.
4. To adopt the use of waste material.
5. To acquire cheap method of construction.
6. To study is to investigate the possibilities of using alternative sand such as pond ash.

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II. LITERATURE REVIEW

2.1 Tushar G. More, Pankaj B. Autade

Use of Pond Ash in concrete is an important eco efficiency drive. It is necessary to find the exact suitable percentages of pond ash so that it is decided to use in varying percentage as 0%, 5% 10%, 15%, 20%, 25%, 30%. And to check the properties of fresh concrete and hardened concrete such as slump and compressive strength, tensile strength, flexural strength respectively. Also concrete plays an important role in long life period of structure so it is also important to check effect on durability by using sulphate attack, chloride ion penetration, drying shrinkage. Study shows the basic properties of Pond ash. It also compares these properties with natural sand. Partial replacement does not cause any adverse effect on properties of fresh concrete. The result shows that concrete giving good strength with partial replacement of fine aggregate. As well as Pond ash is the good if used as filler material in concrete. Thus, it is suitable to use pond ash as fine aggregate or partial replacement with natural sand.

2.2 Aditya Verma, Abhishek Kumar, Ashish Mishra, Arjit Verma

This paper presents a review on utilization of pond ash as partial replacement of cement concrete mix. These days' coal based power plant are very popular, which generates large amount of fly ash, bottom ash and pond ash. The disposal of the fly ash is big challenge from environmental point of view. This study combines the work done in this area by various researchers and shows the effect of addition of pond ash on different properties of concrete.

2.3 K. M. Bagwan, S. S. Kulkarni

Now a day it is important to think about effective utilization of pond ash to preserve natural resources and to have sustainable development. The concrete was prepared with different percentage of pond ash (15, 25, 35, 45 and 55 %) and it was tested at different ages pond ash concrete in fresh state and hardened state was tested. IST and FST of pond ash concrete goes on increasing as replacement level of pond ash with cement increases this is because of less content of cement. Also it is found that rate of increase of compressive strength at early ages mainly 3,7 and 28 days was low and during later age this rate was faster. This shows that later age strength of pond ash concrete is very good and has a scope to use in concrete which are of great importance in the present context of sustainability in the construction field.

2.4 Comparative statement

The sand is partially replaced by pond ash as 10%,15%,20% and 25% of M20 and M25 grade of concrete. The strength of property of mortar with pond ash for strength at 7, 14 and 28 days as per partial replacement by sand and for conventional concrete. The result are to be compare of strength between conventional concrete and partial replacement of sand with pond ash for the concrete grade of M20 and M25 for both conventional and partially replacement of sand with pond ash.

III. METHODOLOGY

3.1 Properties of Materials

3.1.1 Cement

We are using OPC 53 grade of cement in which we are perform properties like specific gravity 3.15, Fineness is 312 M^2/KG, Initial setting time is 130 MIN, Final setting time is 190 MIN, Standard consistency is 28.20 %, Soundness is 1MM.

3.1.2 Sand

The physical properties of sand are specific gravity is 2.65, Water absorption is 3.09, Fineness modulus is 3.20, Zone II.

3.1.3 Aggregate

The physical properties of 10 mm size of aggregate are specific gravity is 2.78, water absorption is 1.63 %. And for 20 mm size of aggregate are specific gravity is 2.78, water absorption is 1.21 %.

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3.1.4 Pond Ash

Ash is the residue after combustion of a coal in thermal power plant. We are performing following properties like specific gravity is 1.5 and sieve analysis 5.20.

3.2 Mix Design

3.2.1 Grade of Concrete M20

IS: 10262 / SP: 23 /IS: 456

TABLE 1
DESIGN STIPULATIONS

Min. Comp. Strength reqd. in The Field at 28 days	20 N/mm2.
Maximum Size of Aggregate	20 mm.
Degree of Workability	Medium (Ref. Sp: 23 Table-22, Page no- 64)
Degree of Quality Control	Good. (IS: 10262, Table-01, Page no-05)
Type of exposure	Severe (SP: 23, Table-23)
Target strength of mix design	26.60 N/mm2
Standard Deviation	4.0 (As per I.S 456)
Accepted proportion of low results	1 in 20
Maximum water Cement Ratio	0.45

3.2.2 Test Data for Material

TABLE 2

Cement Used	Ordinary Portland cement satisfying the requirements of IS:12269
Specific Gravity	
Specific gravity of cement	3.15 OPC 53
Coarse aggregate of 20mm Agg.	2.78 Saidutt (Nalasopara)
Coarse aggregate of 10mm Agg	2.78 Saidutt (Nalasopara)
Fine aggregate of River Sand	2.65 Saidutt (Nalasopara)
Water absorption	
Coarse aggregate of 20mm Agg	1.21%
Coarse aggregate of 10mm Agg	1.63%
Fine aggregate of River Sand	3.09%
Percentage of Coarse aggregate	54%
Percentage of Fine aggregate	46%

3.2.3 Target Mean Strength of Concrete

The target mean strength for the specified characteristic cube strength is 20 +1.65 x 4.0 =26.60 N / mm^2

Fm = Fck + t x s. Fm = targets average compressive strength at 28 days. Fck = characteristic compressive strength at 28 days 20 N/mm2.Standard deviation (s) = 4.0 t=1.65 value of t (IS: 10262-2009)

Selection of Water Cement Ratio

From Table 5 of IS 456 maximum water-cement ratio =0.45

Based on Experience, adopt water-cement ratio as 0.44

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0.44 < 0.45, hence O.K.

Selection of Water Content

From Table 2 maximum water content = 186 liter for 20 mm aggregate

For 100 to 120 mm slump range, based on trials, water content reduction of 22 percen has been achieved. Hence, the arrived water content = 186 x 0.78 = 145 liter.

Calculation Of Cement Content

Water-cement ratio = 0.44

Cementations material (cement) content = 145/0.44 **= 330 kg/m3**

From Table 5 of IS 456, minimum cement content for 'severe'

Exposure conditions = 320 kg/m3

330 kg/m3 > 320 kg/m3, hence, O.K.

Cement (OPC) **= 330 kg/m3**

Proportion of Volume of Coarse Aggregate And Fine Aggregate Content

From Table 3, volume of coarse aggregate corresponding to 20 mm size aggregate and fine aggregate (Zone II) = 0.62

For pumpable concrete on basis of trials these values should be reduced by 13 percent

Therefore, volume of coarse aggregate = 0.62 x 0.87 = 0.54

Volume of fine aggregate content = 1- 0.55 = 0.46

TABLE 3

Mix Calculations								
The mix calculations per unit volume of concrete shall be as follows:								
a)	Volume of concrete		=	1 m3			
b)	Volume of cement		=	Mass of cement	x	1	
				specific gravity of cement		1000	
			=	330	x	1	
				3.15		1000	
			=	0.105 m3			
c)	Volume of water		=	Mass of water	x	1	
				specific gravity of water		1000	
			=	145	x	1	
				1.00		1000	
			=	0.145 m3			
f)							
			=	1- (0.105+0.145)			
			=	0.750			
g)	Mass of coarse aggregate		=	f x volume of coarse aggregate x specific gravity			
				of course aggregate x 1000			
			=	0.750 x 0.54 x 2.78 x 1000			
			=	1126 kg			
h)	Mass of fine aggregate		=	f x volume of coarse aggregate x specific gravity			
				of fine aggregate x 1000			
			=	0.750 x 0.46 x 2.65 x 1000			
			=	914 kg			

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3.2.4 Mix Proportions

Grade	Cement	Water	20 mm	10 mm	R/sand
M20	330	145	631	495	914

3.3 Casting of cubes

(1) The size of mould is 150 mm X 150mm X 150 mm used.

(2) Take the samples and mix in ghamela while concreting

(3) Oiling the mould from inside then pour concrete in the cube in 3 layers

(4) Compact each layer with 25No of stokes with the tamping rod.

(5) Finish the top surface by trowel/thapi after compaction of the last layer.

(6) After 24 hours remove the specimen from the mould.

(7) While removing take care to avoid breaking of the edges.

(8) Submerge the specimen in clean fresh water for the curing until time of testing

(9) Test 3 specimen after 7 days, 14 days, 28 days for curing.

IV. RESULT (FOR CONVENTIONAL CONCRETE)_

TABLE 4

FOR M20 GRADE	Compressive strength (N/MM^2)			Avg. Strength
	Cube 1	Cube 2	Cube 3	
7 Days	22.67	23.11	23.56	23.11
14 Days	28.00	28.00	30.22	28.74
28 Days	Awaited	Awaited	Awaited	Awaited

V. CONCLUSION

- Concluded that by comparing conventional concrete with pond ash we will achieve a better economy, cheap method of construction.
- Performing for M20 & M25 grade of concrete and partially replacement of sand with pond ash by the percentage of 10% 15% , 20% and 25%.
- Concluded maximum strength obtained. With the help of this conclusion we will stop the wastage of pond ash.

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