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Pond Ash as Fine Aggregate in Concrete

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ABSTRACT: In most of the Civil Engineering Constructions, "Conventional Concrete" is the most common material used for preparing structural elements and frames. The Conventional concrete comprises of Cement, Sand, and Aggregates mixed in specific designed water content. These constituents such as sand, aggregates or cement are sources available in nature in abundance. But excess quarrying of these sources had an adverse effect on nature too.

Considering this fact our project work deals with trying to find the best effective alternative materials to replace these basic constituents in concrete. Use Pond Ash to partially replace fine aggregate in concrete mix not only provides an effective solution ton scarcity of sand/ crushed stone but also helps to reduce impact of coal ash disposal on environment.

I. INTRODUCTION:

The progress and development in the infrastructural facilities is generally considered as a symbol of the social and economic development of that country. The advancement in the construction sectors like roadways, waterways, railways, skyscrapers and other civil engineering services help a nation grow in all aspects. All the developed nations of the world have therefore stressed a bit more on providing basic infrastructures to their society and hence their construction industry is more advanced and developed compared to construction industry of other nations.

India being a developing nation has to create much more facilities and services in the construction sector. The construction industry in India therefore has a wide scope for progress and development.

Pond Ash As Aggregate in Concrete:

Severalattemptshavebeenmadetoreplaceth enaturalsandbyvariousmaterials. The new trend in this area is Pond Ash. In the subsequent topics we shalldiscussaboutPondAsh.Inordertoexaminetheusa bilityofcoalashasanaggregatefor concrete, the mechanical properties and durability of concrete using pond-ash wasanalyzedin termsofpond-ashcontent (10,20, 30wt.%) as apart offineaggregate. Utilization of pond ash can result not only in reducing the magnitude of theenvironmentalproblems,butalsotoexploitpondash asarawmaterialforvalueadded products and for extraction of valuable materials. Amongst many uses of pond ash, itsuse as building material is particularlysuitable because it isanticipated, that therewouldbeconsiderable shortfall inproduction ofvarious.

II. LITERATURE REVIEW:

It has become a need of the day to find an alternative to natural sand and provideapropersolutiontotheproblemofenvironment .Manyresearchershavetriedtofindoutvarious alternatives likedemolished bricks, stonedust,flyash and pondash. Literature studies show that utilization of coal combustion products for variousapplications is based only on fly ash and virtually no references were obtained for theuse of pond ash. As a whole there is no major chemical composition difference betweenfly ash and pond ash; however, due to a wide variation in the concentrations of oxideconstituentsuseofpondashinlargequantitieshas beenlimitedforcommercialapplications.

Kumar et al carried-outresearch on engineering behavior of fiber reinforcedpondashintheyear1999.Theirresearchpres entstheresultsoflaboratoryinvestigationsconductedo nsiltysandandpondashspecimensreinforcedwithrand omly distributed polyester fibers. The test results reveal that the inclusion of fibersin soils increases the peak compressive strength, CBR value, peak

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friction angle, andductility of the specimens. It is concluded that the optimum fiber content for both siltysand and pond ash is approximately0.3 to 0.4% of thedryunit weight**. [1]**

An investigation on the use of pond ash for manufacturing bricks in 2002 wascarriedoutby PiyushKantPandey& RajKumarAgrawal.Thisash isgenerallydisposed of in the ash ponds along with other sludges and residues of steel makingoperations.ThischangestheconstitutionofFly ashandmakesthebrickmanufacturing difficult. This paper has attempted to decide the ways for the use of this mixed ash formanufacturing mixed ash clay bricks successfully. The bricks thus made are superior instructural and aesthetic qualities and portents huge saving in the manufacturing costswithbetterconsumerresponse. **[2]**

Lee Bong Chun et al from Korea studied the fundamental properties of concretecontaining pond ash in the year 2008. In this study, sample specimen for five domesticdisposal sites could be procured by implementing geological surveys, and the analysison their grading distribution, chloride contents and the properties of pond ash wasconducted. During the test, ordinary Portland cement has been used. Fine aggregatesand coarse aggregates used in this test are the products manufactured in the regions asIncheon and Nyamangodo, both of which are accordant with the Korean Standards. Theresearch concluded that pond ash should be utilized by identifying its quality whichdiffers along with disposal site. The study also showed that an increase in the content ofpondash mightgive higher strength byalteringthewater cementratio**. [3]**

Mrs.R.S.Bang et al carried an experimental study on pond ash as fine aggregatesinconcretein2009.They made differentproportionsof concrete mixfor differentproportions of replacement of sand by pond ash. Five different mixes were prepared forthis purpose. It was concluded that density of concrete decreases with increase in pondash. They also found that compressive strengthof concrete with pond ash increaseswith morecuringperiod**.[4]**

A. Sofietal investigated the utilization of pondashfor pavementblocksin2009.In this work sand was replaced by pond ash in pavement blocks in differentpercentages like 20%,40%,60%,80% and 100%respectively. The results obtained for100% replacement were found satisfactory. Strength for M20 was found as 46.18 MPaandfor M30 concretethestrength was found tobe36.018 MPa**. [5]**

Ritwik Sarkar et al studied the addition of pond ash on the properties of ash clayburnt bricks in 2009. Two types of ashes were used, pond ash and ESP (Electro-StaticPrecipitator)grade fly ash (both fromTitagarhthermal power plant,WestBengal,India) and local clay (from Durgapur, West Bengal, India). The thermal power plantuses coal from various sources in Bihar, India. Different ratios of clay and ash wereused for making the bricks, which were formed in a hydraulic press. The pressed brickswereдried,firedandcharacterizedfortheconven tionalpropertiesofbuildingbricks.[6]

EXPERIMENTALPROGRAMME:

For the present study, concrete of M20 grade is designed using IS method. Cubesof the above grade are tested at the age of 7, 14, and 28 days. The designed mix isdesignated as M1fordifferent%ofPondash(replacementofFineaggr egates).Variousmixes areprepared suchas M1, M2, M3,M4,and M5.

Concrete Mix Design:

Sr. No	Specimen	Cement (kg/m^3)	Fine Aggregate (kg/m^3)	Coarse Aggregate (kg/m^3)	Pond ash (kg/m^3)	Water (liter)
1	M1	1.428	2.85	5.71	0	0.6
2	M2	1.428	2.1375	5.71	0.7125	0.6
3	M3	1.428	1.425	5.71	1.425	0.6
4	M4	1.428	0.7125	5.71	2.1375	0.6
5	M5	1.428	0	5.71	2.85	0.6

Sample Preparation:

The concrete mixtures prepared were placed in steel cube moulds of 150mmside. After placing the concrete in moulds, it was vibrated using a surface vibrator.Further they were named as M1, M2, M3, M4, and M5 as per the amount of sandreplaced bypond ash. The cubes obtained after demolding were placed in water tank for curing. Theyweretaken outwhenrequiredforcarryingout compressivetests at7, 14and 28days. In total 45

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cubes of side 150 mm were fabricated. Nine (9) cubes of five mixeswere prepared for the work.All the cubes were tested for finding out the compressivestrengthofthefivedifferentmixesandther esultswererecordedinMPa.Allthe compressiontestswereconductedonCompressionTes tingMachine(CTM).Thecapacityof the CTM is 40 tones.

Test Results:

Sr. No	**Mix**	**Age Indays**	**CompressiveStrength(MPa)**	**Replacement ofFineAggregates**
1	M1	7	19.85	0 %
		14	23.11	
		28	32.78	
2	M2	7	17.56	25 %
		14	23.17	
		28	32.33	
3	M3	7	17.33	50 %
		14	18.66	
		28	25.33	
4	M4	7	16.89	75%
		14	17.62	
		28	23.11	
	M5	7	16.29	100 %
		14	17.48	
		28	20.14	

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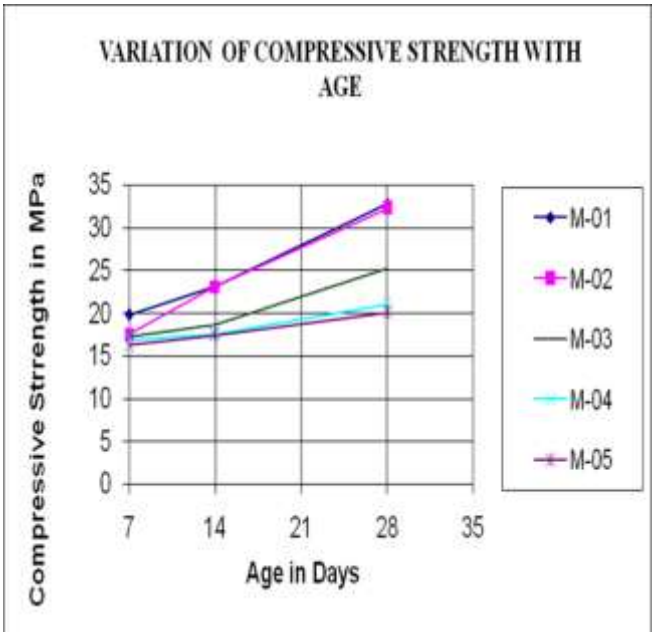

The average compressive strengths of all mixes

The28daysaveragecompressivestrengthoft hecontrolmixM1for0%replacement is 32.78 MPa.The same strength for M2 is almost equal to that of M1 for25% replacement of sand by Pond ash. The strength of M3 for 50 % replacement byPond ash is 25.33 Mpa.The results show that the compression strength decreases when50%ofnaturalsandisreplacedwithPondash.The 28daysstrengthforM4having75
%of Pond ash further decreased which is 23.11MPa and that for M5 having 100 %Pond ash was minimum i.e. 20.14 MPa.In general, the compressive strength of concretedecreaseswith theincreasein Pond ash contents.

III. CONCLUSION:

From the results of the study to utilize Pond Ash as fine aggregate for concrete;thefollowingconclusions can bedrawn;
From the results of the study to utilize Pond Ash as fine aggregate for concrete; the following conclusions can be drawn;
1.The average compressive strength of Control Mix M1 at 28 days is 32.78 MPa
2.The average compressive strength of Concrete gradually decreases when the percentage of Pond ash increases.
3.The average compressive strength of Concrete Mix M2 having 25 % of sand with Pond Ash by weight of sand was almost equal to the compressive strength of Mix M1 which was 32.33 MPa.
4.Further the average compressive strength of Mixes M2, M3, M4 and M5 decreases as the percentage of Pond Ash increases and is minimum for Mix M5 with 100 % replacement of sand with Pond ash whose compressive strength is minimum i.e., 20.14 MPa.
5.The basic aim of this project is to save the excess consumption of natural sand and find an alternative for the same. The use of concrete containing Pond ash should be promoted in applications where good strength of concrete is not preferred.
6.With the use of Pond Ash concrete, though not entirely, but at least to some extent the consumption of natural sand can be reduced. This project work can be considered as an initial step towards the same.

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