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USE WASTE MATERIAL OF SIKKA POWER PLANT- (MOUND ASH) IN CONCRETE REPLACEMENT AS FINE AGGREGATE

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Abstract-*The use of alternative aggregate is a natural step in solving part of depletion of natural aggregates. The investigation on alternative material for concrete making started much before than half a century.*
Use of hazardous waste in concrete making will lead to green environment & sustainable concrete technology, Concrete made from mound ash (sikka thermal power plant waste) as fine aggregate will be studied for workability, compressive strength, tensile strength and Flexural strength Further, study of its durability will ensure greater reliability in its usage. So here in my project, I will use mound ash (sikka thermal power plant waste) as replacement of coarse aggregate by different percentage for making concrete of different grade from lower to higher like M-20 and M-30, an. The percentage replacement will be 0%, 10%, 20%, 30%, 40%, 50%, 60%,70% 80%, 90% and 100% with natural fine aggregates. I will use OPC-53 grade cement in making concrete with super plasticizer as an admixture to get proper workability for higher strength concrete.

Keyword-*mound ash, super plasticizer, and workability.*

I. INTRODUCTION

Mix design M-20 grade of concrete was usedto study the different harden properties ofconcrete. Mound ash was taken from Gujarat state electricity corporation limited,sikka, and Jamnagar city inGujarat. Mound ash has coarse particlesize, higher water absorption and usually lesspozzolanic effect than fly ash. It is dumped ordischarged in form of mound by conveyer belt, in mass quantity and iseasily available with minimum cost. By studyingprevious research papers, it shows that,thermal power plant waste material has a potentialto be used as fine aggregate in concrete. Thethermal power plants are the main source ofpower generation in India. These thermalpower plants have been generating about twothirds of the power demands of the country.There are about 40 major thermal power plantsin India. World at present produces aroundapproximately 1528 million tons of coal fly ashwhere India at present produces around 120million tons of coal ash per annum. Themoments.beneficial use of fly ash in concrete is thepreferable option for safe and economicalutilization of million tons of fly ash. There is acritical need to find new methods for using mound ash for its highest and best use. The major obstacle in use of mound ash in a concrete isthat the chemical properties of mound ash aredifferent from place to place and are dependsupon the origin of the coal and also the porosity is high.

II. LITERATURE REVIEW

P. Aggarwal, Y. Aggarwal, S.M. Gupta. [1] The workability of concrete decreased with the increase in bottom ash content due tothe increase in water demand. The density of concrete decreased with the increase in bottom ash content due to the low specific gravity of bottom ash as compared to fine aggregates. Compressive strength, splitting tensile strength and Flexural strength of fine aggregate replaced bottom ash concrete continue to increase with age for all the bottom ash contents.
S M Waysal , P D Dhake1 and M P Kadam[2] An effects on concrete by replacement of sand as thermal power plant pond ash on properties such as compressive strength, split tensile strength, flexural strength and Modulus of Elasticity, are studied. The natural sand was replaced with pond ash by 0%, 20%, 40%, 60%, 80%, and 100% by weight, at fixed water-cement ratio 0.48.

Outcome**:**The compressive strength for 7 and 28 days was increased up to 20% replacement and after that compressive strengths were decreased from 40% to 100% replacement.The split tensile strength and flexural strength was increased at 7 and 28 days for 40% replacement and after that it was decreased for remaining replacement.

Abdulhameed Umar Abubakar, KhairulSallehBaharudin[3]The result of the grain size analysis indicated that Tanjung Bin coal bottom ash is higher percentage of coarse sand particles. lower specific gravity of fly ash & bottom ash is as a result of the chemical composition which is lower in lime & alumina content. Tanjung Bin bottom ash aggregate absorbed 19% by weight and dry aggregate in contrast to just 2% of normal weight aggregate and it also indicates that there is a direct relationship between the rate of absorption & time..

K. Soman[4] To investigate and identify supplementary by-product materials that can be used as substitutes for constituent materials inconcrete is the need of the present. Bottom ash is an abundant waste from furnace of thermal power plants and other industries.Studies so far done have revealed that bottom ash will increase the durability in several cases.Based on this experimental study, the following conclusions are drawn. The study shows that 30% replacement of M Sand withbottom ash has given a 28 day compressive strength of 38.43 MPa (target mean strength is 38.25kN/m2). The result shows thatbottom ash can be used to substitute M sand and the optimum replacement level is 30%.The use of bottom ash in concrete will reduce the environmental problems arising from filling it in land. As a result of reducedsand consumption the problems in sand mining can also be reduced. The reduction of landfill costs and ill effects of land fillingalong with reduction in sand mining finally leads to sustainable development.

III. OBJECTIVE AND SCOPE

Our prime objective is to check waste material of sikka power plant (mound ash) can replace the natural fine aggregate or can increase different properties of different grades of concrete for economic & environmental benefits.Study of waste material mound ash.It is partial size is coarse compared to cement so we can use replacement as a fine aggregate. The natural sand was replaced with mound ash 0 % to 100% by weight.Measure effects on fresh concrete and Hardened Concrete properties.To compared the test results of ordinary concrete and mound ash replacement concrete specimens. To find Optimum content of mound ash (waste of power plant) use in concrete.

IV. METHEDOLOGY

Cement 53 grades Ordinary Portland cement is used for this work. This cement is the most widely used one in the constructionindustry in India. Course and fine aggregates and Coarse aggregates of 10 mm and 20 mm size was used, and natural sand of bhohavo, gujarat was used for this study. Mound ash is obtained from sikkathermal power plant gujarat. Super Plastizer-PLASTCONE AP430 is used as directed by themanufacture to improve the workabilityconcrete. Number of trials was taken to decidethe doses of Super plastizer in concrete to achievethe required 100 mm slump.

Material property

The physical properties of coarse aggregate, fine aggregates and mound ash was determined. The fineness modulus of mound ash was found to be 2.01, whereas coarse aggregate and sand was 5.76 to 6.79 and 3.75, respectively. The specific gravity of mound ash was less as compared to fine aggregates. It was found that the water absorption was very high of mound ash as compared with sand and coarse aggregates. the fineness modulus, specific gravity and water absorption of coarse aggregates, sand and mound ash respectively.

Table 1: Mound Ash Chemical Compassion

Sr. No.	Test	Sample: **Mound Ash**	Unit
1	SiO_2 (Sodium Silicate)	72.1	% By wt.
2	CaO (Calcium Oxide)	1.02	% By wt.
3	Al_2O_3(Aluminium Oxide)	-	% By wt.

Table 2:physical property

Property	Mound ash	Coarse aggregate	Fine aggregate
Specific Gravity	2.1	2.74	2.67
Water absorption	13.5 %	0.67	1.01

Testing program

Mix design was carried out as per IS:10262-2009 concrete mixture with different proportions of pond ash ranging from 0% (for ordinary mix) to 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% and 100% replacement for sand were considered. The M-20 grade mix design was selected for w/c ratio 0.55 and slump was considered 50 to 100 mm. For this work testing was carried out at 7 days and 28 days. Total 54 cubes specimen, 54 cylindrical specimens and 54 beam specimens were casted and tested for compressive strength, split tensile strength, and flexural strength. For this work total 162 test specimen were casted and tested. Table 3 shows mix proportions and mix ratio. Table 4 shows the material consumed with different proportions of mound ash with cement in kg/m^3.

Table 3: mix proportion (Kg/m^3) and Mix ratio

Water	Cement	Coarse aggregate	Fine aggregate
191.6	353.18	1154.6	783.6
0.55	1	2.21	3.26

Table 4: concrete material for different replacement(Kg/m^3)

Sr. no Of mix	% of replace meant	CEMENT (Kg/m^3)	WATER (ml)	SAND (Kg/m^3)	COURSE AGG. (Kg/m^3)	MOUND ASH (% OF sand) (Kg/m^3)
BN – 0	0 %	358.18	197	783.6	1154.6	0
BN – 1	10 %	358.18	197	705.26	1154.6	78.36
BN – 2	20 %	358.18	197	626.90	1154.6	156.72
BN – 3	30 %	358.18	197	548.54	1154.6	235.08
BN – 4	40 %	358.18	197	470.17	1154.6	313.45
BN – 5	50 %	358.18	197	391.81	1154.6	391.81
BN – 6	60 %	358.18	197	313.45	1154.6	470.17
BN – 7	70 %	358.18	197	235.08	1154.6	548.54
BN – 8	80 %	358.18	197	156.72	1154.6	626.90
BN – 9	90 %	358.18	197	78.36	1154.6	705.26
BN 10	100 %	358.18	197	0	1154.6	783.60

Preparation of test

For mixing the concrete a half bag mixture was used. First coarse aggregates of 20 mm, 10 mm were placed in the mixture then sand and cement were mixed together in dry state then after water was added and mixed until the homogeneous mixture were obtained. Each batch is mixed around 3 to 5 min and then mixture was placed in a metallic try and immediately slump was checked before the concrete was placed in different mould. For this work drinking water was used for mixing and curing process.

Cube

Cube of size 150 mm × 150 mm × 150 mmwere used. The cube were cleaned thoroughlya waste cloth and then properly oil was appliedalong its faces. Concrete was then filled inmould in three layers, while filling the mouldconcrete was compacted using tamping rodof length 600 mm having a cross sectional areaof 25 mm2 and then the mould are kept on planeand level surface in the laboratory for 24 h andcubes are removed from the mould and keptfor curing.

Cylindrical

Cylindrical mould of diameter 150 mm andheight 300 mm were used. The oil was appliedalong the inner surface of the mould for easyremoval of cylinder from the mould. Concretewas poured in three layers and well compactedby tamping rod.

Beam

Beam mould of size 100 mm × 100 mm × 500mm was used. The oil was applied along theinner surface of the mould for easy removal ofbeam from mould. Concrete was pouredthroughout its length and well compacted bytamping rod.

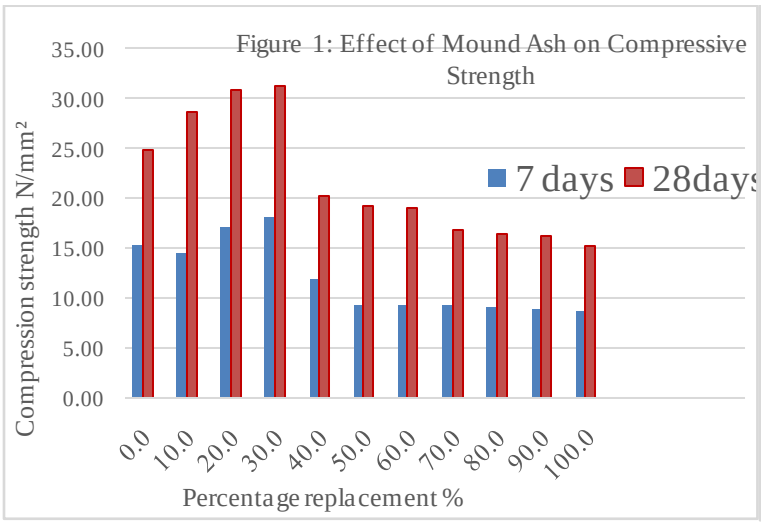
Curing

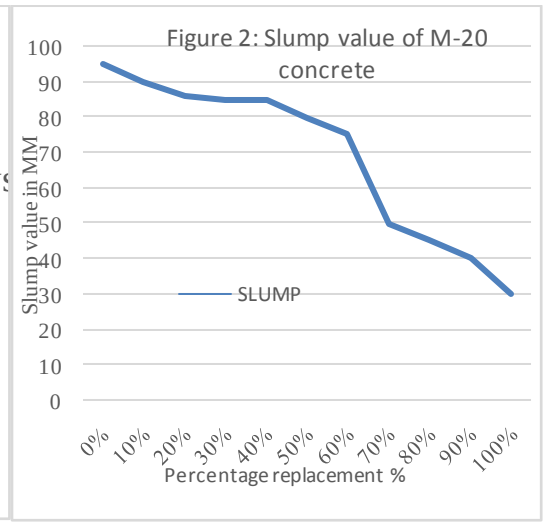
After casting of all cubes, cylindrical specimenand beam specimen are kept for curing incuring tank and drinking water was used forthroughout curing process.

V. RESULTS AND DISCUSSION

Effect of Mound Ash on Compressive Strength

Compressive strength of concrete made withand without pond ash of cubes size 150 mm ×150 mm × 150 mm was determined at 7 and 28 days. The test results are as shown in Figure 1. The maximum load at failure readingwas taken and the average compressivestrength was calculated using the followingrelation.

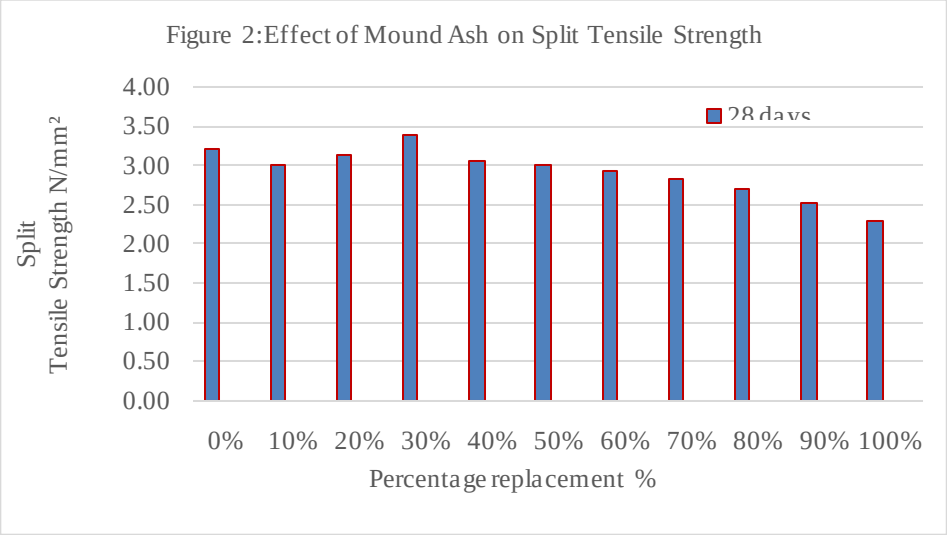




Here 0% to 100% of mound ash was replaced with sand and optimum percentage of replacement was found at 30% replacement of pond ash with sand. For ordinary concrete the compressive strength was found for 7 and 28 days. It was observed that for 30 % sand replacement the compressive strength was increased as compared with ordinary concrete. Then after that compressive strength were decreased from 30% to 100% replacement. The mound ash concrete gains strength at a slower rate in the initial period and acquires strength at faster rate.

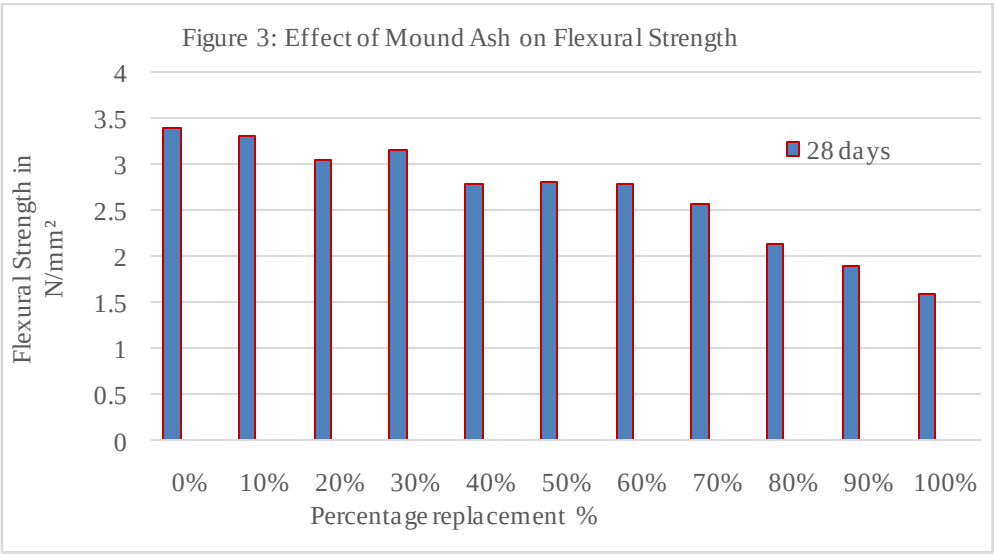
Effect of Coal Pond Ash on Split Tensile Strength

The specimen of size 150 mm in diameter and length of 300 mm were cast and tested under the digital CTM of capacity 300 ton. The specimen was kept under CTM at the center load was applied with pace rate 1.2 KN/s and ultimate loading was noted. Split tensile strength was shown in Figure 2. The spilt tensile strength was calculated according to IS - 5816-1970 and IS 516 – 1959 code by the $\sigma bt = 2p/\pi$ DL Where σbt = split tensile strength in N/mm2, P = Maximum load at failure, L = span, D= Diameter of specimen. The split tensile strength for concrete was found for 7 and 28days respectively. It was found that the split tensile strength for 28 days was increased up to 30%. It was observed that from the Figure 2 that the splitting tensile strength of concrete decreases with the increase in the percentage of fine aggregates replacement with the mound ash, but the splitting tensile strength increases with the age of curing.



Effect of Coal Pond Ash on FlexuralStrength

The beam specimen of size 100 mm × 100 mm × 500 mm was tested for single point load at the midpoint under the UTM machine. The flexural strength was calculated as perIS 456 – 2000 and IS 516 – 1959 by using therelation σbt = PL/bd2 Where σb = Modulus ofrupture in N/mm2, P = Maximum load, L = span,b = width of specimen, d = depth of specimen.The flexural strength was constantly decreased form 0% to 100% replacement.



V.CONCLUSION

Thermal power plant waste material like mound ash can use in concrete parcel replacement as fine aggregate.
Workability will decline where increasing percentage of replacement.
Maximum 30% replacement possible in concrete regarding compressionand tensile strength.
Density of concrete decline where increasing percentage of replacement.

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