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Research Paper

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Experimental Investigation on Concrete Using Brick Powder and Metakaolin

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***Abstract*—** Concrete is a material used in building construction, consisting of a hard, chemically inert particulate substance, known as aggregate, that is bound by cement and water. Density of normal concrete is in the order of about 2500 kg per cubic meter for conventional concrete. In construction industry, consumption of cement and sand is increase day by day as well as cost is also increasing. So to reduce the consumption of cement and sand, there is a need to replace a part of cement by some pozzolanic material to reduce the consumption of cement to control the environmental pollution to some extent. The Experimental are carried out to explore the possibility of using 10% Met kaolin (MK) and 10%, 15% and 20% of brick powder (BP) as a replacement of cement in concrete mixture. The use of Metakaolin and brick powder is produced. The main focus of this project has been studies that flexural behavior of concrete made with 10% Metakaolin and 10%, 15% and 20% brick powder as a replacement of cement. The cubes were tested at 7 and 28 days. The Compressive strength of these cubes is compared with the strength of referral concrete (design mix concrete M35). The experimental work carried out and the result obtained are presented and discussed in this report.

Keywords—Metakaolin, Brick powder, Super plasticizer

I. INTRODUCTION

All over the world growth is being witnessed in construction industry in many countries. India is one of the fastest growing economies in the world. Infrastructure sector is a key driver for the India economy. In construction industry, consumption of cement is increasing day by day as well as cost is increasing, so reduce the consumption of cement partial replacement with some alternative material such as Metakaolin and brick powder. These are in cementious properties. Here study strength and flexural behavior of concrete made with Metakaolin and brick powder. These are in cementious properties.

A. MET KAOLIN

Metakaolin is not a by-product. It is obtained by the calcinations of pure or refined kaolinite clay at a temperature between 6500°c and 8500°c, followed by grinding to achieve a finesse of 700-900 m^2/kg. It is a high quality pozzolanic material, which is blended with cement in order to improve the durability of concrete.

B. WASTE BRICK POWDER

Bricks are a widely used construction and building material around the world. In developing countries bricks are still one of the most popular construction materials. India is the second largest producer of fired clay bricks after china. Bricks are s widely used construction and building material around the world. Waste brick powder is used as a cement substitute.

C. SUPER PLASTICIZERS

Super Plasticizers are also known as high range water reducers are additives used in making high strength concrete. They are chemical admixtures.They also produce a high strength concrete.

D. OBJECTIVE OF THE STUDY

- Examine the behavior of concrete by partial replacement of cement with brick powder and Metakaolin.
- To makes sustainable concrete with more economical for construction.
- To compare the result for conventional concrete and modified concrete.
- To interpret the experimental result into graphical result.

E. SCOPE

- The waste material from the industries can be effectively used in the replacement of cement.
- It minimizes the production cost of concrete.
- It reduces the percentage used of conventional cement in concrete.
- It can increase the various strength parameter of concrete.

II. REVIEW OF LITERATURE

M. Nageswara Rao et al. (2018) have concluded that, the cement was partially replacement by Metakaolin in the proporsion of 5%, 10%, 15%, 20% and 25%, and quarry dust was partially replacement of fine aggregate in the

proporsion of 10%, 15% and 20%. The cube is made for 7 and 28 days for the testing of compressive, split tensile and flexural strength of concrete. The main advantage of these studies is safe disposal of quarry dust and makes a concrete in economical.

Muhammad Umar et al. (2018) have concluded that, Brick dust was used in plain cement concrete to check its fresh and hardened properties. Brick dust was used to check the workability and strength of concrete, using w/c ratio 0.55 which was kept constant during research. Three samples were cast for each 3, 7. 14, 28 and 56 days with 0%, 5%, 10%, 15% and 20% incorporation of brick dust. The split tensile strength is increase with increase of brick dust up to 15%. Brick dust act as plasticizer as it decreases water demand because workability increase. The maximum slump values are observed in 15% of replacement and minimum values are observed in 20% of replacement.

Ramesh J et al. (2017) have concluded that, brick powder as a partially replacement of cement. The brick powder was made in percentage of 5%, 10%, 15% and 20% of the weight of concrete. The partial replacement of brick powder has helped to increase the compressive strength of the concrete. It also gives good aesthetical view to the concrete when compared with conventional concrete.

R. Nasar Ali et al. (2017) have concluded that, a M30 grade concrete mix by incorporating 25% of granite fines and 0 to 20% of brick dust which replaces the cement. Also this paper discusses the improvement of concrete strength by using 60% of quarry dust, 40% of river sand 75% of 20mm, 25% of 12mm coarse aggregate. The experimental result shows the better compressive, split tensile, flexural strength.

III. METHODOLOGY

This chapter briefly explains the methodology adopted in this experimental work. In first phase, the physical properties of ingredients of concrete and fresh concrete properties have been found and a mix design for M35 concrete was calculated. This chapter briefly explains the methodology adopted in this experimental work. It has already been discussed in the previous chapter about use of Metakaolin and brick powder in concrete and their effect on strength parameter of concrete in the core objective of this experimental work.

A. EXPERIMENTAL METHOD

The following methodology has been followed in this experimental investigation, preliminary tests on Metakaolin and brick powder. Mix design for M35 grade of concrete.

Mix proportion such as follow

i. Conventional
ii. 10% brick powder+ 10% Metakaolin+ 100% sand+ 100% coarse aggregate.
iii. 15% brick powder+ 10% Metakaolin+ 100% sand+ 100% coarse aggregate.
iv. 20% brick powder+ 10% Metakaolin+ 100% sand+ 100% coarse aggregate.

Table. 1 Mix ratio for M35

Mix ID	C	BP	Mk	FA	CA	Water	SP
Cube							
CC	2.994	0	0	1.913	4.989	1.35	0.04
M1	2.395	0.29	0.29	1.913	4.989	1.35	0.04
M2	2.246	0.45	0.29	1.913	4.989	1.35	0.04
M3	2.096	0.59	0.29	1.913	4.989	1.35	0.04
Cylinder							
CC	4.642	0	0	2.965	7.736	2.09	0.06
M1	3.714	0.46	0.46	2.965	7.736	2.09	0.06
M2	3.482	0,69	0.46	2.965	7.736	2.09	0.06
M3	3.249	0.93	0.46	2.965	7.736	2.09	0.06
Prisms							
CC	4.287	0	0	2.143	4.285	1.54	0.04
M1	3.424	0.428	0.43	2.143	4.285	1.54	0.04
M2	3.310	0.642	0.43	2.143	4.285	1.54	0.04
M3	2.996	0.856	0.43	2.143	4.285	1.54	0.04
Total	38.84	5.361	2.72	28.08	68.04	19.91s	0.58

IV. RESULTS AND DISCUSSION

The plain samples of cubes, cylinders and prism were cured for 7 and 28 days in water at room temperature. The specimens were taken for testing such as compressive test, split tensile strength test and flexural strength test. Three numbers of specimens in each were tested and average value is calculated. The results were compared with that of conventional mix. The experimental results of concrete mixed with brick powder and Metakaolin were discussed in this chapter.

A. COMPRESSIVE STRENGTH OF CUBES

Compressive strength is most important property of the hardened concrete. The concrete were casted, cured and tested for 7 and 28 days. Compressive strength results of concrete are listed in table. The highest compressive strength value is 53.24 N/mm^2 which is obtained at 28 days for M35 grade by replacement of 15% of brick powder and 10% of metakaolin in concrete when compare to the conventional mix.

Table. 2

Curing days	Cube No.	Control Specimen	% of replacement (N/mm^2)		
			10%	15%	20%
7 days	C_1	23.5	31	37.27	25.73
	C2	23	29.5	37.11	25
	C3	24	31.1	37.71	25.81
Avg. strength for 7 days (N/mm^2)		23.5	31	37.27	25.73
28 days	C1	35	48.11	52.19	36.3
	C2	35.5	49	53.24	36.53
	C3	38	13.11	53.12	35.9
Avg. strength for 28 days (N/mm^2)		35	49	53.24	36.6

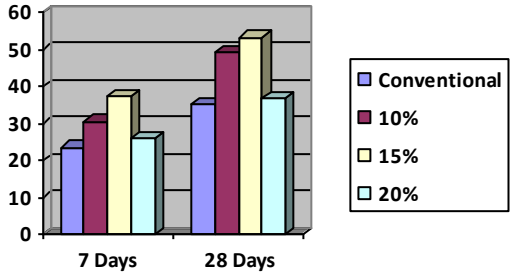

Fig.. 1

B. SPLIT TENSILE STRENGTH OF CYLINDERS

The split tensile strength results of concrete cylinder specimens for 7 and 28 days are presented in the Table and comparisons of result are shown.

Table. 3

Curing Days	Cube No	Control Specimens	% of replacement		
			10%	15%	20%
7 days	Cy1	1.687	1.69	1.91	1.47
	Cy2	1.91	1.822	1.95	1.69
	Cy3	1.576	.93	2.15	1.55
Avg. Strength for 7 days (N/mm^2)		1.687	1.822	1.95	1.55
28 days	Cy1	2.49	2.42	2.74	2.14
	Cy2	2.41	2.46	2.39	2.11
	Cy3	2.39	2.61	2.79	2.21
Avg. Strength for 28 days (N/mm^2)		2.41	2.61	2.79	2.21

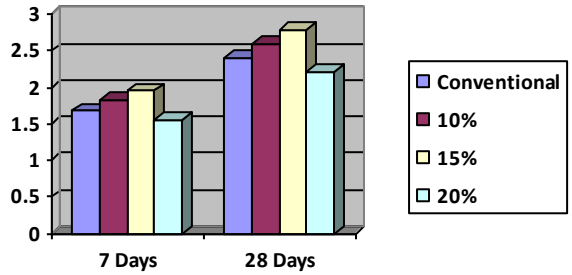

Fig. 2

C. FLEXURAL STRENGTH OF PRISM

The Flexural test Result for the prism specimen are presented in the table.

Table. 4

Curing days	Cube No.	Control specimen	% of replacement (N/mm^2)		
7 days	P1	2.01	2.327	2.65	2.21
	P2	2.17	2.49	2.32	2.31
	P3	2.25	2.11	2.55	2.27
Avg. Strength for 7 days (N/mm^2)		2.17	2.327	2.55	2.27
28 days	P1	3.10	3.32	3.64	3.25
	P2	3.04	3.29	3.55	3.18
	P3	3.04	3.25	3.68	3.27
Avg. Strength for 28 days (N/mm^2)		3.11	3.32	3.64	3.25

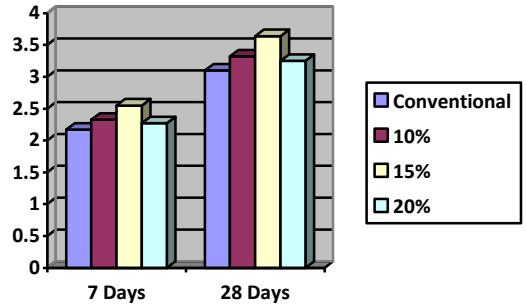

Fig. 3

V. CONCLUSION

Experimental investigations were carried out to determine the characteristic of various grades of concrete M35 by replacement of cement with brick powder and Metakaolin. Concrete specimens were casted and tested for determined the compressive strength, split tensile strength and flexural strength. Based on the test results it was inferred that at which percentage replacement with brick powder and Metakaolin gives the better result than the conventional concrete with respect to 7 and 28 days compressive strength, split tensile strength and flexural strength.

- Concrete acquries maximum compressive strength at 15% of brick powder and 10% of Metakaolin replaced for cement in M35 grade of concrete.
- The maximum split tensile strength of concrete is attained at 15% of brick powder used concrete compared to other proportional concrete.
- Low cost houses can be constructed using brick powder concrete.
- This mix designation gives good compressive strength and also gives good strength.

REFERENCES

[1]. Abdul Razak, "Strength estimation model for high-strength concrete incorporating Metakaolin and silica fume, Cement and Concrete Research, Vol.**35**,pp. **688-695**, **2005**.

[2]. Amritpal kauril, Raj Winder Singh Bansal, "Used Metakaolin research that strength and durability properties of concrete with partial replacement of cement with Met kaolin and marble dust", ISSN: 2278-0181, Vol. **4**, ISSUE.**07**, July **2015**.

[3]. B. Krishna Rao and M. Anil Kumar, " A study on partial replacement of cement with Metakaolin and Fine aggregate with waste Foundry dust ", International Journal of Engineering Research, Vol. **5**, Issue. **12**, **2016**.

[4]. Beulah M, "Effect of replacement of cement by Met kaolin on the properties of High Performance Concrete Subjected to Hydrochloric Acid Attack", IJERA, Vol. **2**, Issue **6**, pp. **033-038**, **2012**.

[5]. M. Usha Rani and J. martina Jenifer, "Mechanical Properties of concrete with Partial Replacement of Portland Cement by Clay Brick Powder", International Journal of Engineering Research and Technology, ISSN: 2278-0181, Vol.**5**, Issue **02**, **2016**.

