iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** IV **Month of publication:** April 2017

DOI: http://doi.org/10.22214/ijraset.2017.4131

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Volume 5 Issue IV, April 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Experimental Investigation on High Strength Concrete by using Alccofine and Superplasticizers

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Abstract*: This paper presents the experimental investigation on High strength concrete by using varying percentage 0, 5, 10, 15, 20 and at constant 0.6% of superplasticizers admixtures which is replaced by weight of Portland pozzolana cement. The experimental investigation is carried out to evaluate the compressive and flexural strength of the concrete by varying percentage of alccofine. The mix proportions of concrete had a constant percentage of superplasticizers which is based on the required degree of workability. The concrete specimen are curing at 7 and 28 days under normal atmospheric temperatures. The results of adding alccofine gives the excellent results . The proportion mix can achieve their characteristics strength at by adding 10% of alccofine in replacement of PPC and after addition of 10% alccofine shows that strength decreases.*
Keyword*: High strength concrete, Alccofine, Super plasticizer, Compressive strength, Flexural strength.*

I. INTRODUCTION

In all over the INDIA the infrastructure developments keeping a view of requirements of high strength concrete in the construction sector for high rise building ,bridges etc. High strength concrete makes by using locally available coarse aggregate, fine aggregate and Portland pozzolana cement with alccofine and super plasticizer admixtures with varying properties of these materials has been presented in the project work.

Alccofine is property of low calcium silicate. It is low calcium silicate based mineral additive. It granulation is controlled by process and results in unique particle size distribution. Its gives latent hydraulic property and pozzolanic reactivity results in hydration process of concrete. Alccofine improves the packing density of paste component and due to improve packing density lowering water demand, lowering admixture dosage and hence improving strength and durability parameters of concrete at all ages. Alccofine is a new generation, micro fine material which much finer than other hydraulic materials like cement, fly ash, silica etc. being manufactured in India. Alccofine has unique properties to enhance the 'performance of concrete' in fresh and hardened stages due to its much finer particle size.

his paper envisages the use of alccofine as partial replacement of PPC in M-40 and M-50 grade of concrete. The percentage replacement of PPC by alccofine was 0%, 5%, 10%, 15% and 20%. The test specimens (cubes) casted and tested as per relevant IS code of practice for 28 days compressive strength.

II. LITERATURE REVIEW

As per Ansari U.S. et.al, "Studied that the compressive strength of concrete of OPC concrete with ALCCOFINE and fly ash is compared and it has been found that the strength of concrete got increased by 20% with partial replacement of cement by ALCCOFINE. For M-70 grade of concrete.

As per Saurabh Gupta" studied that Effect on compressive strength of high performance concrete incorporating alccofine and fly ash" the Compressive strength of high performance concrete with the replacement of cement with Alccofine and Fly ash, and also with natural sand to manufactured sand. The compressive strength was determined at 3, 7 and 28 days. The addition of Alccofine shows an early strength gaining property and that of Fly- ash shows long term strength. The ternary system that is Ordinary Portland cement-fly ash-Alccofine concrete was found to increase the compressive strength of concrete on all age when compared to concrete made with fly ash and Alccofine alone.

As per Sudarsana Rao Hunchate et.al, studied that High performance concrete with normal ingredients we use mineral admixtures like Silica fume, fly ash and metakoline and workable agents Super plasticizers are also used. The usage of mineral admixtures in the concrete not only enhances its strength properties but also durability. The compressive strength is investigating finding the optimum use of mineral admixture (Silica fume of levels 0, 5, 10, 15, 20 and 25% at 7 days and 28 days of curing).

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Volume 5 Issue IV, April 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

III. EXPERIMENTAL INVESTIGATION

A. Materials Cement

In this experimental investigation Portland pozzolana cement was used.

B. Fine Aggregates

The fine aggregates used in this investigation was Natural River sand passing through 4.75 mm sieve with specific gravity of 2.60. The percentage of passing is within the limits as Indian Standard Specification. The fine aggregate corresponds to the zone II gradation as per IS 383:1970**.**

C. Coarse Aggregates

Normal crushed broken stone angular in shape was used as coarse aggregates. Two fraction of coarse aggregates were used, 20mm size having specific gravity of 2.64.

D. Alccofine

Alccofine has unique properties to enhance the 'performance of concrete' in fresh and hardened stages due to its much finer particle size. Alccofine is manufactured by some controlled conditions with special technique to produce micro fine size. Alccofine is generally two types one is low calcium silicate which is Alccofine 1203 and other is high calcium silicate which is Alccofine 1101.

E. Water

Ordinary tape water clean, potable free from suspended particles and chemical substance was used for both mixing and curing of concrete.

TABLE 1: CONSTITUENTS OF DIFFERENT MIXES FOR M-40 GRADE

Mixes	**M-400**	**M-405**	**M-410**	**M-415**	**M-420**
Cement (kg/m3)	345	360.53	341.55	322.58	303.60
Water (kg/m3)	136.2	136.67	136.65	136.65	136.65
Sand (kg/m3)	685	672	673	673	673
Coarse aggregate (kg/m3)	1261	1240	1240	1241	1241
Alcco fine (kg/m3)	0.00	18.97	37.95	56.92	75.90

TABLE 2: CONSTITUENTS OF DIFFERENT MIXES FOR M-50 GRADE

Mixes	M-500	M-505	M-510	M-515	M-520
Cement (kg/m3)	394	411.30	389.7	368	346
Water (kg/m3)	136.67	136.70	136.70	136.67	136.68
Sand (kg/m3)	667	654	654	656	656
Coarse aggregate (kg/m3)	1230	1206	1206	1206	1207
Alcco fine (kg/m3)	0.00	21.65	43.30	64.95	86.60

M 400, M500- concrete mix without any replacement.
M405, M505- concrete mix with 5% replacement of PPC by alccofine.
M 410, M510- concrete mix with 10% replacement of PPC by alccofine.
M 415 , M515- concrete mix with 15% replacement of PPC by alccofine.
M 420, M520 concrete mix with 20% replacement of PPC by alccofine.

F. Grade of Concrete

The mix proportion of this investigation was 1:1.98:3.65 at w/c ratio 0.39 for M40 grade and 1:1.69:3.12 at w/c 0.35 for M50 grade

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concrete was adopted.

IV. PREPARATION OF SPECIMENS

The strength characteristics of concrete with varying percentage of alccofine were studied by casting cubes. The constituents of the concrete viz, cement, fine aggregate and coarse aggregate were mixed to appropriate proportion by adding water Alccofine is added to the different mix in varying proportion as a partial replacement for cement. Moulds for cube of size 150x150x150mm (60 cubes) and beams 100mm x 100mm x 500mm (60 beams) were prepared and concrete was poured in to the mould layer by layer and vibrate thoroughly. The specimens were removed from the moulds after 24 hours and then the specimens were cured with water for 28 days.

V. RESULT AND DISCUSSIONS

It was found from the experimental results that the compressive strength has increased for the specimens with varying percentage of alccofine as replacement for cement when compared with the conventional concrete at percentage of 10% after that adding of alccofine increases the strength decreases gradually. The optimal dosage at 10% gives the good strength. The test result obtained are presented in table 3.

TABLE 3:- 7 AND 28 DAYS COMPRESSIVE STRENGTH OF CONCRETE CONTAINING VARIOUS PERCENTAGE OF ALCCOFINE

Mix no.	7 days strength (N/mm2)	28 days strength (N/mm2)
M400	19.44	27.93
M405	23.89	34.24
M410	26.58	38.54
M415	23.22	35.14
M420	21.62	31.10
M500	24.21	34.70
M505	29.26	42.72
M510	33.6	47.95
M515	30.03	43.12
M520	26.49	37.26

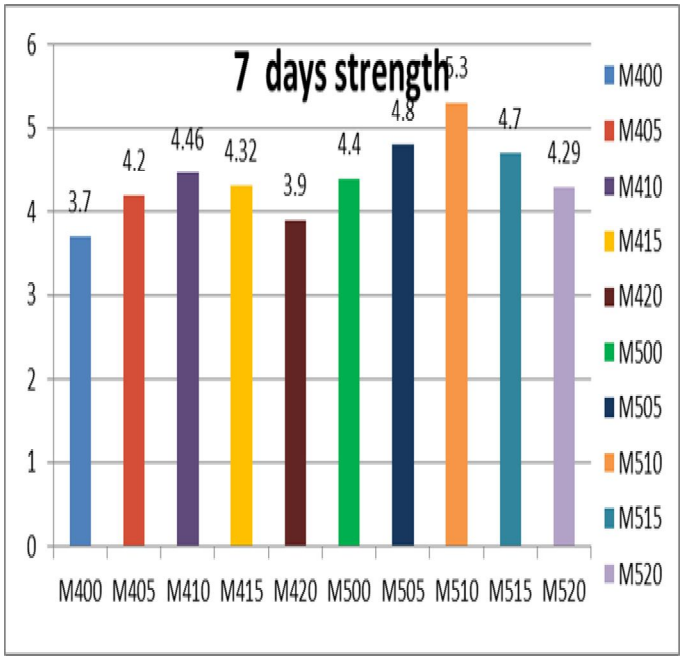

Fig. 1: Graphical representation of 7 days strength obtained for mixes

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Volume 5 Issue IV, April 2017
ISSN: 2321-9653
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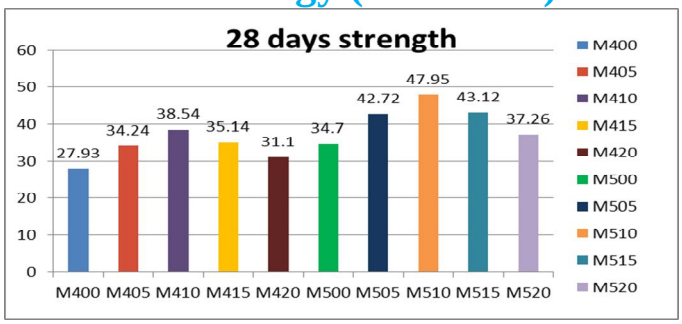

Fig. 2: Graphical representation of 28 days strength obtained for mixes

TABLE 4:- 7 AND 28 DAYS FLEXURAL STRENGTH OF CONCRETE CONTAINING VARIOUS PERCENTAGE OF ALCCOFINE

Mix no.	7 days strength (N/mm2)	28 days strength (N/mm2)
M400	3.7	4.32
M405	4.2	4.69
M410	4.46	4.90
M415	4.32	4.75
M420	3.90	4.48
M500	4.4	4.9
M505	4.8	5.3
M510	5.3	5.5
M515	4.7	4.8
M520	4.29	4.4

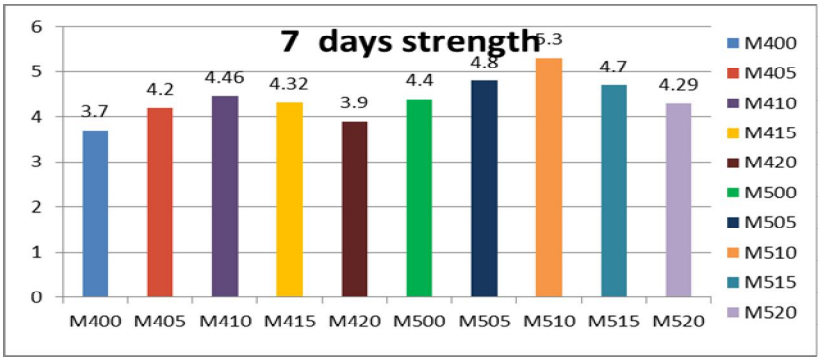

Fig. 3: Graphical representation of 7 days flexural strength obtained for mixes

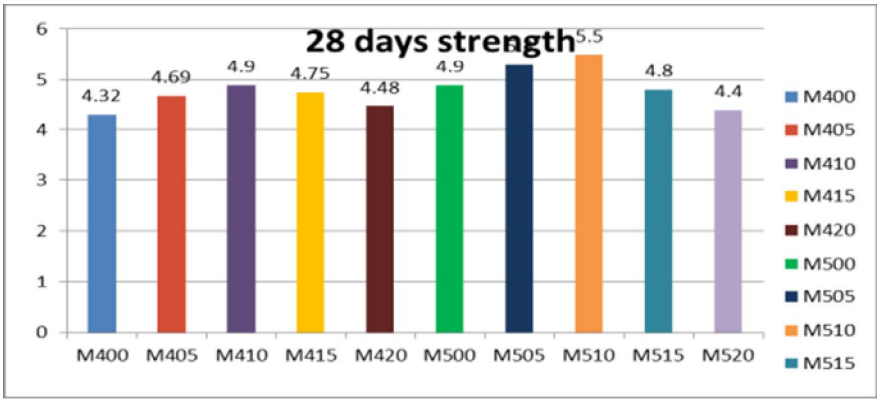

Fig. 4: Graphical representation of 28 days flexural strength obtained for mixes

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Volume 5 Issue IV, April 2017
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TABLE 5: MIXES VS WORKABILITY FOR TRIAL MIXES

Mix	Slump (mm)
M400	55
M405	42
M410	30
M415	15
M420	07
M500	51
M505	35
M510	28
M515	12
M520	04

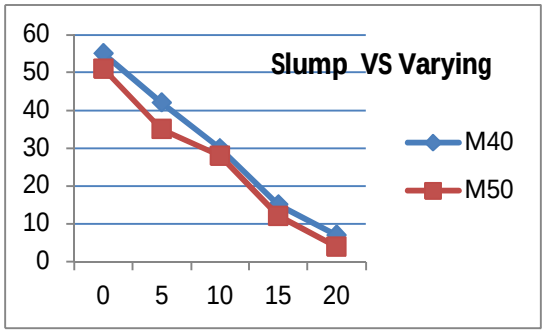

Fig.5: Graphical representation of Slump for M40 and M50 grade at varying % of alccofine

VI. CONCLUSIONS

In this study series of the experiments have been conducted on concrete with the addition of alccofine as partial replacement of PPC. In the alccofine was used as partial replacement of PPC in different percentage that is 0%, 5%, 10%, 15% and 20% of the dry weight of the cement. The experiments were conducted on M-40 AND M50 grade of concrete as per relevant IS code of practice. Based on the test results obtained from this study the following conclusion can be drawn.

A. The addition of alccofine in the concrete as partial replacement of PPC increases the 28 days compressive strength significantly.

B. The 28 days compressive strength goes on increasing and it was found to be maximum at 10% replacement and after this the strength is decreases.

C. The increase in 28 days compressive strength at 10% replacement was found to be 37.98% for M40 grade and 38.18% for M50 grade of concrete.

At 20% replacement the strength is approximately same as the strength without any replacement of PPC by alccofine.

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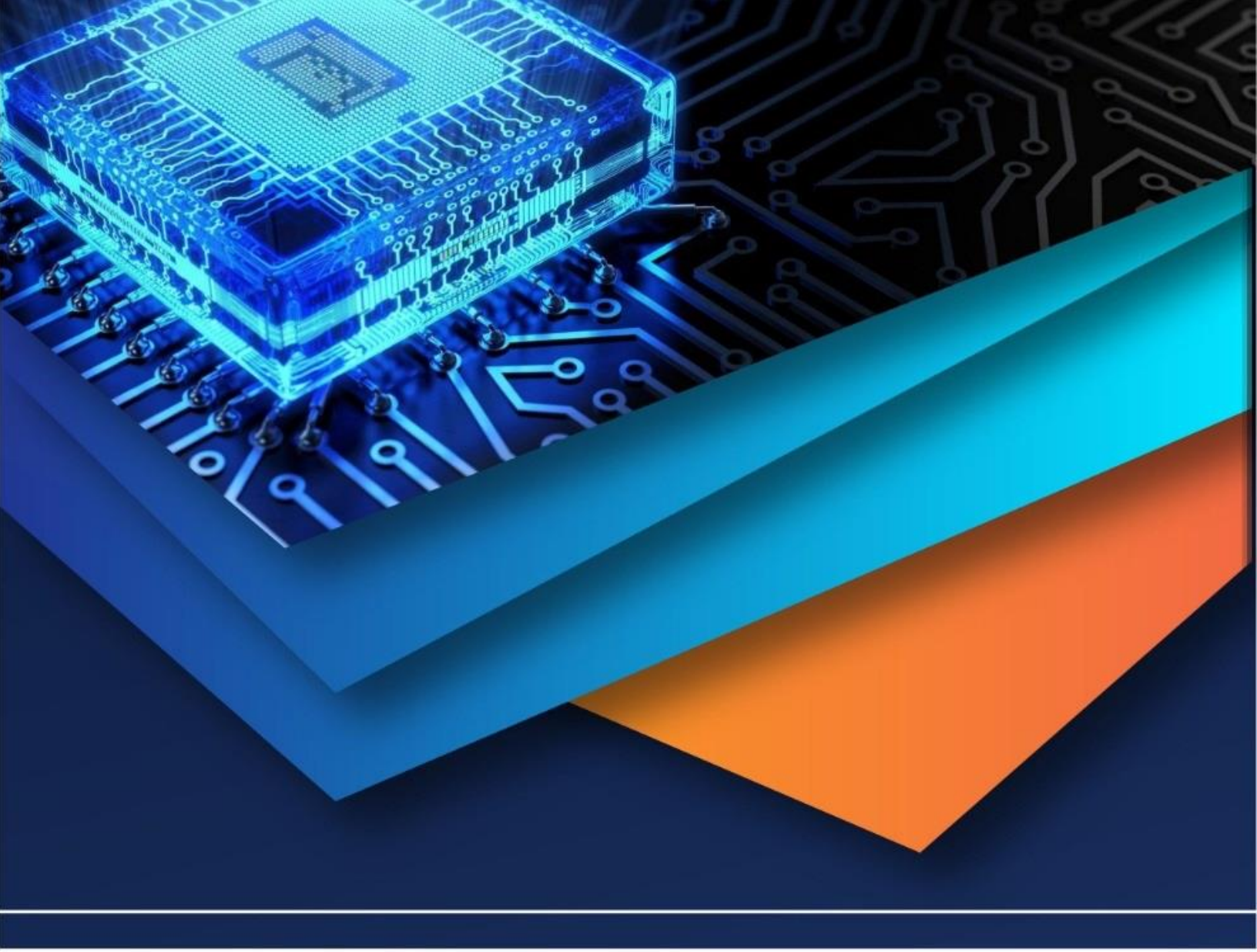

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