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High Strenth Concrete with Varying Content of Micro Silica.

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Abstract :- **Concrete is the most important engineering material in construction industry because of its inherent strength properties. However, the addition of some other materials may change the properties of concrete. With increase in trend towards the wider use of concrete for pre-stressed concrete and high rise buildings there is a growing demand of concrete with higher compressive strength.. The mineral admixtures with pozzolanic properties such as fly ash (FA), silica fume (SF), ground blast-furnace slag (GGBS) and metakaolin (MK) are commonly used as a partial substitution of Portland cement during construction. These admixtures are often added to modify the physical and chemical properties of cementitious mixes. In comparison to ordinary Portland cement, the collection of flyash as a by-product requires less energy and it produces less greenhouse gases. Thus, flyash blended concrete is a more environmentally friendly concrete compared to OPC concrete. This paper presents the study of variation of contents of micro silica in the mix consisting of cement, Flyash, and micro silica. Micro silica is used in three percentages 0%, 7%, and 10% and the compressive strength test of cubes is being conducted.**

Keywords: **- compressive strength, cementitious content , flyash , Micro silica, pozzolanic.**

I. INTRODUCTION

Fly ash, ground granulated blast-furnace slag, silica fume, and natural pozzolans, such as calcined shale, calcined clay or metakaolin, are materials that when used in conjunction with Portland or blended cement, contribute to the properties of the hardened concrete through hydraulic or pozzolanic activity or both. Supplementary cementitious materials are added to concrete as part of the total cementitious system. They may be used in addition to or as a partial replacement of Portland cement or blended cement in concrete, depending on the properties of the materials and the desired effect on concrete. Traditionally, fly ash, slag, calcined clay, calcined shale, and silica fume were used in concrete individually. Today, due to improved access to these materials, concrete producers can combine two or more of these materials to optimize concrete properties. Mixtures using three cementitious materials, called ternary mixtures, are becoming more prominent.

II. MATERIAL

FLYASH is also known as "pulverized fuel ash" in the United Kingdom, is one of the residues generated by coalcombustion, and is composed of the fine particles that are driven out of the boiler with the flue gases. Ash that falls in the bottom of the boiler is called bottom ash. Depending upon the source and makeup of the coal being burned, the components of fly ash vary considerably .The recycling of fly ash has become an increasing concern in recent years due to increasing landfill costs and current interest in sustainable development.

Silica fume, also known as microsilica, is an amorphous (non-crystalline) polymorph of silicon dioxide, silica. It is an ultrafine powder collected as a by-product of the silicon and ferrosilicon alloy production and consists of spherical particles with an average particle diameter of 150 nm. The main field of application is as pozzolanic material for high performance concrete. Silica fume is an ultrafine material with spherical particles less than 1 μm in diameter, the average being about 0.15 μm.

Cement, type of cement is important mainly through its influence on the rate of development of compressive strength of concrete. The choice of the type of cement depends upon the requirements of performance at hand. The most commonly used cement is ordinary Portland cement. Variation in the cement quality will cause the compressive strength to vary more than any other single material.

2.1 Tests on material

The materials required and determining their various properties has been carried out in this phase. The Constituents of concrete viz. cement, fine aggregate, and coarse aggregate are procured and their various properties are determined.

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Table -1: Properties of Cement

Property	Average value for OPC used in present investigation
Specific gravity	3.15 (standard)
Fineness(%)	4
Consistency (%)	30
Final setting time (min)	78
Initial setting time (min)	380

Table -2: Test results of physical Properties of Coarse Aggregate

Sr no	Property	Average value
1	Specific Gravity	2.88
2	Water absorption	0.97%
3	Moisture content	-
4	Type	Crushed
5	Maximum Size	20 mm

Table 3 : Test results of Physical Properties of Fine Aggregate

Sr no	Property	Average value
1.	Specific Gravity	2.67
2.	Water absorption	1.23%
3.	Moisture content	-
4.	Fineness Modulus	4.97
5.	Type	Natural Sand
6.	Grading Zone	III

III. MIX PROPORTIONS

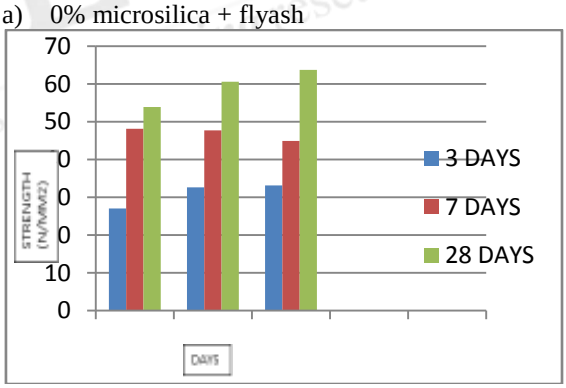
Mix proportions are determined for the proposed grade of concrete (M60) by partially replacing cement with flyash and micro silica.

Mix components	Mix 1 (micro silica 4%)	Mix 2 (micro silica 7%)	Mix 3 (micro silica 0%)
Cement	400	385	410
Fly ash	110	110	130
Micro silica	20	37	-
20mm	770	790	820
10mm	360	360	350
River sand	450	435	280
Artificial sand	300	288	420
Water content	140	140	135
Admixture	161 gm (9 cubes)	173gm (9 cubes)	226gm (9 cubes)

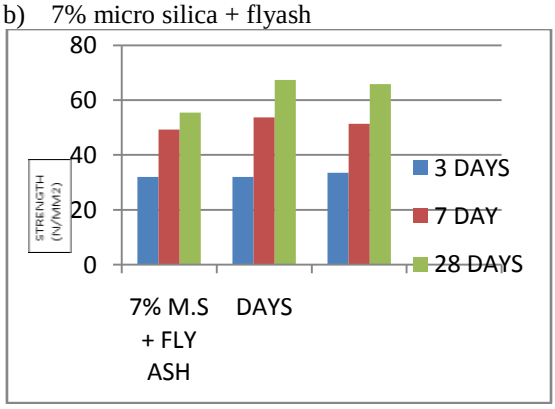
IV. RESULTS AND DISCUSSION

The test was carried out on number of specimens prepared by using different contents of the materials. In the mix cement was partially replaced by flyash and micro silica, where the percentage of micro silica is varying (0%, 7% and 10%). Test was carried out at 3, 7, 28 days and results were obtained.

a) 0% microsilica + flyash



b) 7% micro silica + flyash



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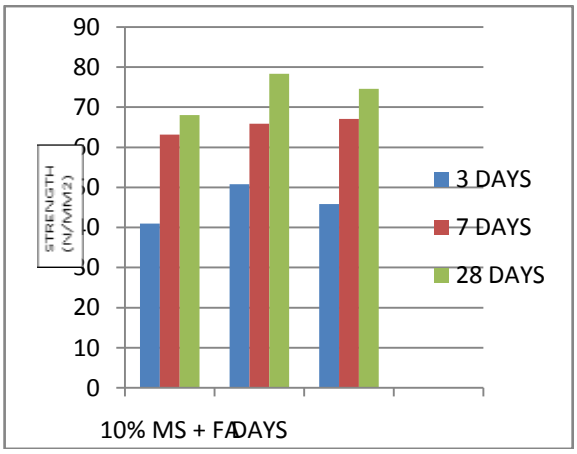
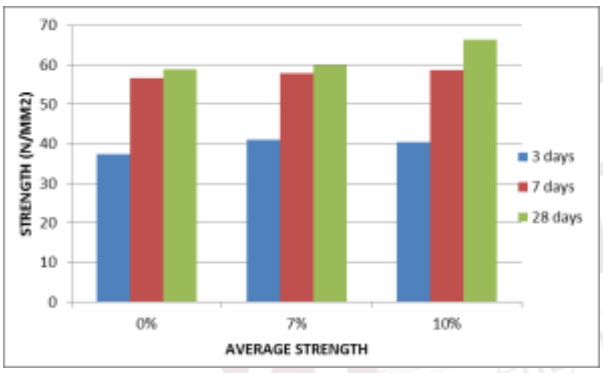
c) 10% microsilica + flyash



d) average strength



This study gives the results for the mix tested by conducting compressive strength test on the cubes (150x150x150 mm). Silica fume has strong effects in compressive strength of concrete for 3, 7 and 28 days of age. Graph a, b, c shows the variation of strength for 0%,7%,10% micro silica for 3,7,28 days. The variation of compressive strength for different replacement levels of OPC by silica fume for 3, 7 and 28 days is shown in graph(d), which shows the average strength for variable proportions of micro silica. For 28 days concrete it was observed that maximum compressive strength (71.98 N/mm2) was exhibited which possess, 10% micro silica, 20% flyash and 70% cement.

V. CONCUSION

- Other materials than cement containing cementitious properties can be effectively used as a replacement of cement giving required results for the mix.
- Fly ash is more prominently used material with cement as it proves to be a good binding agent with cement, giving required specified designation of concrete.
- Micro silica can be added upto 10% of the total cement content to increase the strength of the mix effectively.
- These varying proportions of mixes proves as an better alternative to cement with environmental benefits and solves the problems of disposal of these other by products

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