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Studies on High Performance Concrete Using Mineral Admixtures

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Abstract: High performance concrete is made using byproducts called cement replacement materials. Comparatively little information has been published regarding the results of different Effects of mineral admixtures on concrete's microstructural and team performance characteristics under various curing regimes. Additionally, it is unclear how concrete's strength relates to its conductivity and porous structure. Workability of the new concrete as well as engineering characteristics like cube and revised cube compressive strength and flexural strength were among the properties examined. The findings demonstrate that lanaba dry curing makes concretes weaker, more porous, with a increased pore size, and more permeable. It was discovered that tiny amounts of silica fume can make up for the reduction early in life compressive strength caused by the insertion of bagasse ash from sugar cane. With increasing concentrations of sugar cane bagasse ash or slag in the mixtures, the microstructural and engineering characteristics and concrete's capacity to breathe that contain them they seem to be more vulnerable to inadequate than concrete cubes for curing.
Keywords: Cement, Flyash, Silica fume, Super plasticizer (SF6), High Perfrmenace Concrete.

I. INTRODUCTION

High Performance Concrete is characterised as a concrete that satisfies a unique set of performance and uniformity standards that are not necessaril routinely achievable with conventional ingredients and customary mixing, putting, and curing procedures. The manufacturing using precast pylon, frameworks and girders for several extended span bridges across the world now makes substantial use of HPC.

One of the most important new materials for use in new construction and in the renovation pf structure like bridges, roads, and buildings is high performance concrete(HPC). The surge of high-rise structures and towers has led to an increase in the demand for HPC in Jordan. HPC has the followings advantages:-

1) To use the concrete considerably sooner in its life.
2) To create high-rise structures by reducing column diameters andexpanding available space.
3) To erect long-span bridge superstructures.
4) To meet the perticular requirements o unique bids,such as stability,elastic modulus and flexural strength.The cement type and quantity, the w/c ratio, the aggregate form and grade, the new concrete's ability to be worked admixtures, chemical additives, curing condition, and the age of the concrete are all factors that affect HPC’s stregnth.

II. NEED OF STUDY

The majority of researchers examining the impact of fly ash, silica fume, and slag on the the resilience of concrete have focused their attention on the notion of mixing cement with just one combining agent to the samples and giving them a thorough curing, by anything at all putting plastic bags over them to keep it awayt moisture lack or by submerging them in water before putting any durability tests to the test. Therefore, it was determined from a survey of recent writing that there isn't a lot of published information on the impact of fly ash and silica fume mineral admixtures on the engineering and microstructural qualities of concrete. Additionally, just a small research has been done on the performance of fly ash/silica fume combined concrete mixes and slag/silica fume under curing regimes that are likely to reflect the behaviour of concrete in actual conditions, despite the significant impact the effects of moisture on concrete's characteristics and its concert .As a result, data on the performance of concrete with and without a substitution of cement and other materials components must be gathered under a variety of curing circumstances that simulate the curing that concrete would experience in real-world applications. Size, dynamic modulus, pulse rate, and strength, and pore structure are additional and permeability, concrete durability is also important. Therefore, the goal of the "Fliis Study" is to create a high-performance, long-lasting concrete with a practical variety of fly ash and silica fume combinations which would produce concrete with adequate high strength above 50 MPa and good superb microstructure (i. e. greatest economy).

III. HIGH PERFORMANCE CONCRETE

In general, it's really acknowledged that was excellent ways to protect the dignity of concrete against environmental assault is to choose durable concrete that has high strength and minimal porosity and permeability. In order to develop high performance concrete, The utilisation of cement substitutes has increased a crucial part of a global strategy. Their advantages in terms of engineering and economics are already well known. to give steel the desired level of corrosion protection. The cement component of the concrete is principally responsible for the development of its qualities, features, and durability.

In order to improve the fundamental properties both the fresh and hardened forms of the resulting concrete phases, Portland cement is increasingly more frequently combined with mineral admixtures like fly ash (FA) and silica fume (SF), either separately or when combined Due to its long-term performance, blended cement concrete has recently gained a lot of acceptability in the Arabian Gulf's marine environment, where there has been an increase in investment in concrete building. Along with offshore oil industry buildings, a £410 million causeway. Currently under construction in Bahrain are an unique, each of which will cost hundreds of millions of pounds.

Despite these enormous financial investments, there is still great uncertainty regarding the durability and lack of frequent maintenance and repairs of these concrete structures. For usage in building these structures, the blended OPC-SF cement made from regular Portland cement comes highly recommended. Investigated were the the longevity characteristics under of these concrete systems varied curing circumstances.

IV. LITERATURE REVIEW

Toutanji and El-Korchi (1996) described a test in which SF replaced 17 and 26%, respectively, of the cement employed in the paste and mortar, as determined by bulk. Four alternative water/cement (w/c) ratio blends, with the appropriate amount of super plasticizer added, were tested: 0.22, 0.25, 0.28, and 0.31.

Their findings demonstrated that adding SF in place of some of the cement improved the compressive strength of mortar but had no impact on the compressive strength of paste.The impact of substituting FA and SF for cement with various w/c ratios of 0.32, 0.41, and 0.52. They discovered that FA enhanced concrete's peak-after compressive behaviour with a smaller curve in the stress-strain curve's descending portion. After 28 days, they found that a 16% SF and 27% FA substitute greatly boosted the compressive strength. According to Shannag (2000), the 28-day compressive strength of concrete increased by 26% as a result of the inclusion of 15% pozzolan and 15% SF. be greater than the concrete's strength lacking SF for mixtures with a 0.35 w/cm ratio. The discrepancy was larger as the SF content increased.

According to Langan et al. (2002), using SF to aid in the hydration of concrete had a number of advantages(1) Significantly increased concrete compressive strength. (2) A decrease in the amount of cement needed to achieve a particular goal strength (conserving cement and lowering the the price of concrete) and (3) A rise in when added, hardened concrete's durability in the right quantities Malaikah (2003) looked at the characteristics of HSC with w/c ratios between 0.22 and 0.38 along with addition with a rise in SF at the following rates: 0%, 12%, and 16%, respectively.

The findings demonstrated that the addition of 10% SF with a 0.20 w/c ratio produced the strongest results, with a strength surpassing 100 MPa. The immediate and distant terms mechanical characteristics of high-strength concrete including various quantities of SF were experimentally investigated by Mazloom et al. in 2003. The workability of concrete reduced as the quantity of SF rose. However, short-term mechanical characteristics like secant modulus and 28-day compressive strength increased. A test that examined the characteristics of high-strength concrete built from mixes with varying percentages of FA and SF and a w/c ratio ranging from 0.26 to 0.55 was documented by Nassif et al. in 2003. FA replacement ranged from 10 to 30%, while SF replacement fell between 5 and 15%.

The findings demonstrated that including SF increased strength at a young age. Additionally, for all ages up to 90 days, mixing 20% FA with different SF percentages had a negative impact on both strength and modulus values. Additionally, 5% SF with 10% FA was the ideal combination that produced the greatest strength. Mostofinejad and Nozhati (2005) made an effort to derive a few experimental models to forecast the elasticity modulus of HSC. 45 mix proportions were made, including 5 SF ratios of 0, 5, 10, 15, and 22%. When the w/c ratio was 0.40, SF was substituted for cement at a rate of 10%, and when the w/c ratio was 0.50, SF was substituted for cement at a rate of 15%. The ideal SF percentage doesn't appear to be constant and rises when the w/c ratio falls. They claimed that ideal SF fraction that created the highest elasticity modulus was not always the same as the one needed to achieve the highest compressive strength.

Table 1: Compressive Strength after 7 Days

Percentage of SGBA and SF	Compressive Strength $N/^2$ after 7 Days
0	55.66
02/5	55.22
20/10	54.11
20/15	54.55
20/20	53.88
20/25	52.11

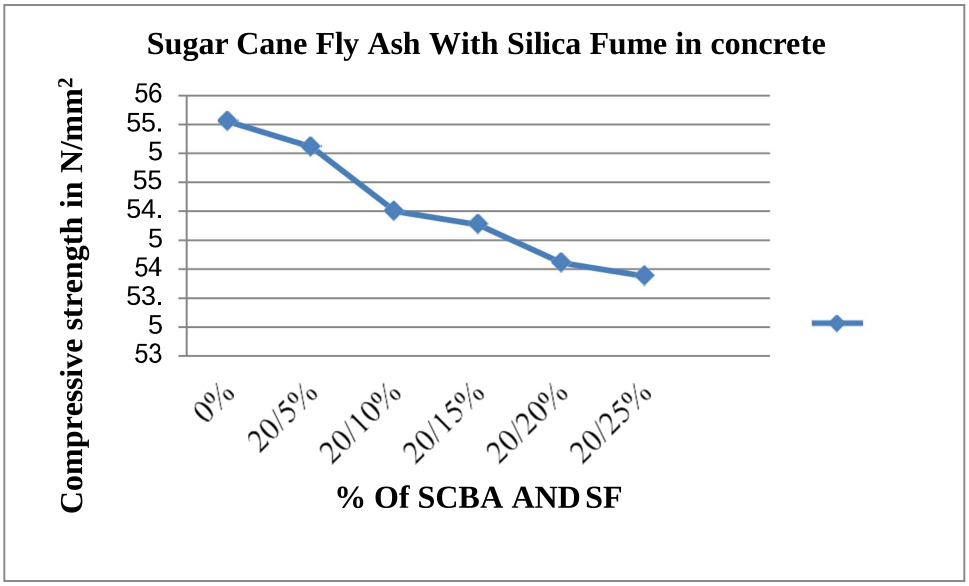

Fig 1: Variation of Compressive Strength with Fly Ash and Silica Fume after 7 days.

Table 2: Compressive Strength after 14 Days

Percentage of SGBA and SF	Compressive Strength in N/mm^2 after 14 Days
0	57.44
02/5	57.22
20/10	57.66
20/15	56.55
20/20	56.11
20/25	55.88

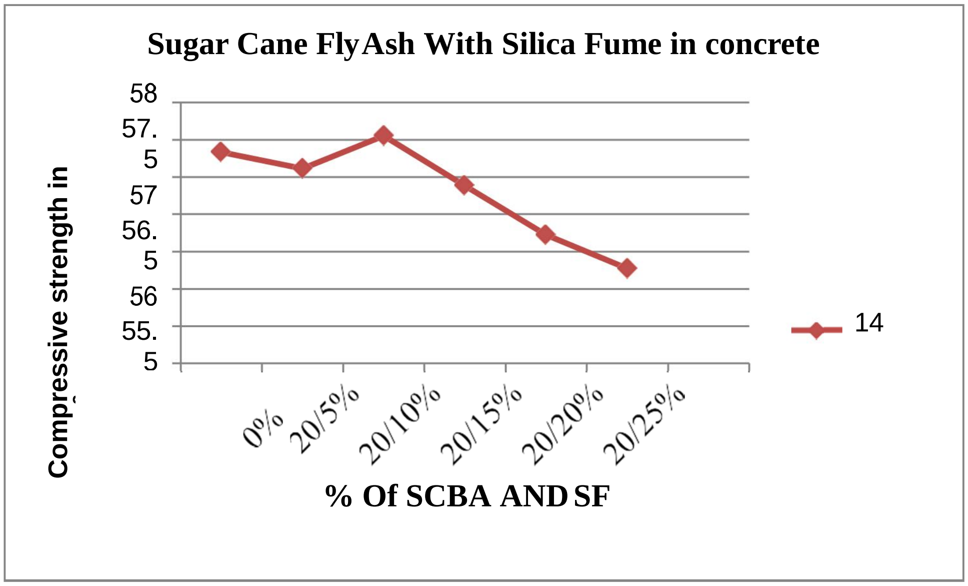

Fig 2: Variation of Compressive Strength with Fly Ash and Silica Fume after 14 days.

Fig 2.1: Compressive strength test procedure and loading condition

Table 3: Compressive Strength after 28 Days

Percentage of SGBA and SF	Compressive Strength in N/mm^2 after 28 Days
0	59.88
02/5	58.11
20/10	59.22
20/15	58.55
20/20	57.55
20/25	57.33

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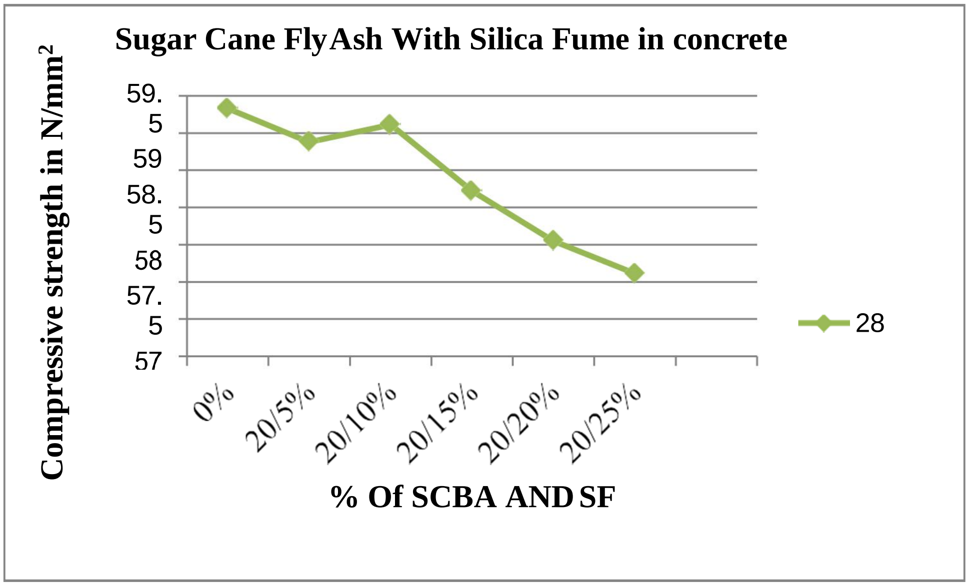

Fig 3: Variation of Compressive Strength with Fly Ash and Silica Fume after 28 days.

V. CONCLUSION

1) The Fly ash high performance concrete is discussed in the light of the findings of the experimental experiments (M50).
2) Concrete with a great strength and a suitable substructure was made using combinations of FA/SF utilised as just a restoration of just cement at various amounts. The research's chosen curing conditions significantly altered the characteristics of concretes, particularly those with high replacement levels.
3) Compared to controlled concrete, fly ash concrete is more affordable. It has been demonstrated that fly ash may be utilised to create concrete that is sturdy, long-lasting, green, and affordable. Concrete made from industrial waste helps to lessen environmental pollution.
4) The fresh and hardened characteristics of concrete will both be improved if the Fly is burned again at a regulated temperature.
5) It was discovered that the flexural strength of various concrete mixtures and the effects of curing was rather well associated with the compressive strength.

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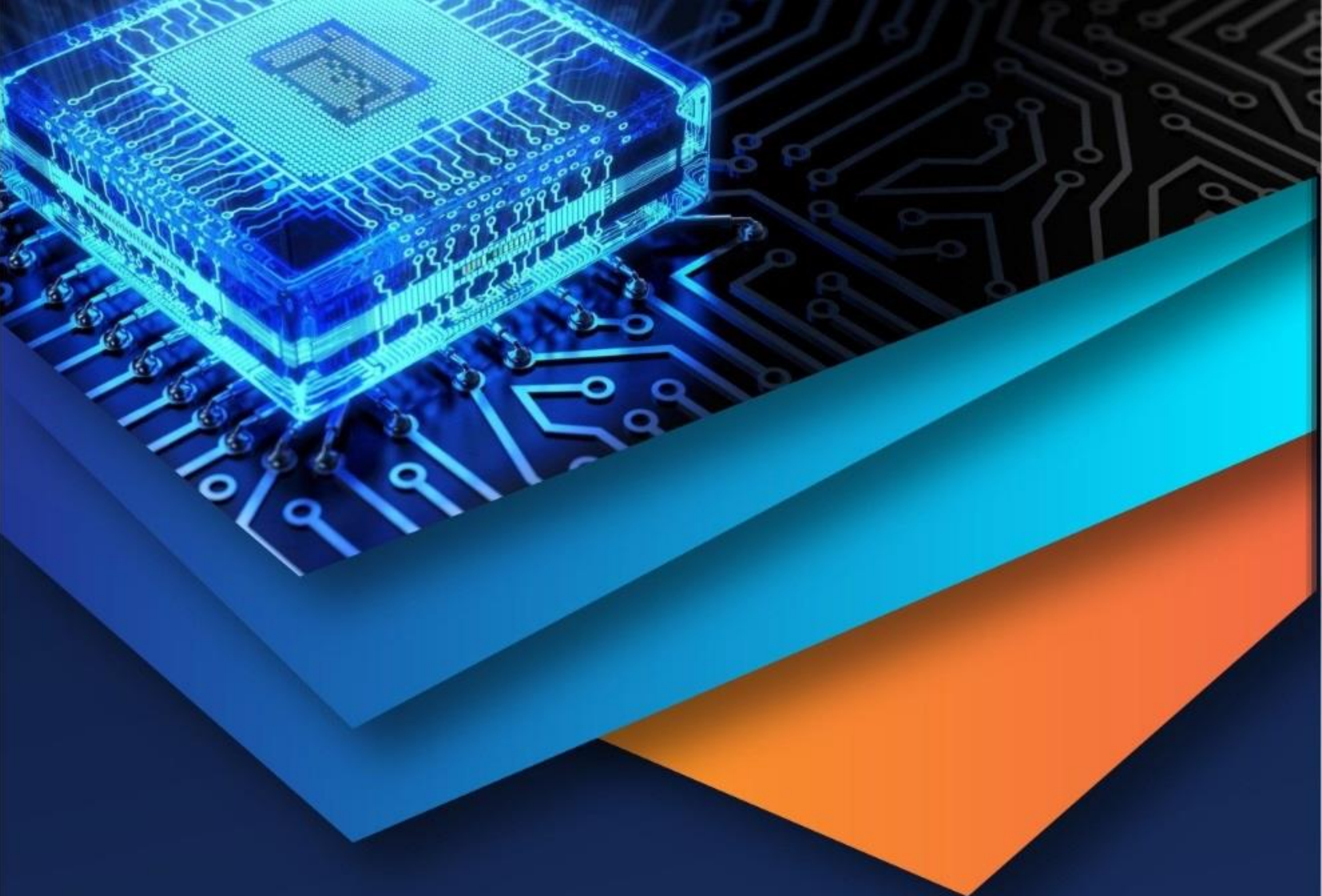

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