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Comparative Study on the Effect of Different Admixtures in Concrete

Nandona Goswami[1], Bikash Barma[2], Hassanul Faruque[3], Sudip Nag[4], Saharup Alom[5]
[1] *Assistant Professor, Civil Engineering Department, Scholar's Institute of Technology and Management, Guwhati, Assam, India*
[2, 3, 4, 5] *B.Tech Students, Civil Engineering Department, Scholar's Institute of Technology and Management Guwhati, Assam, India*

Abstract: ***Concrete is one of the most widely used construction material across the world. It is a composite material composed of aggregate bonded together with fluid cement that cures over time. Various types of admixtures are added to concrete mixtures in order to reduce the cost of concrete construction; to modify the properties of hardened concrete; to ensure the quality of concrete during mixing, transporting, placing, and curing; and to overcome certain emergencies during concrete operations. In this study, an attempt has been made to obtain the better type of concrete sample by adding different types of admixtures. Concrete samples are prepared by using two types of admixture i.e. chemical and economical admixtures. Slump test was performed in fresh concrete samples and Compressive strength test has been conducted for the hardened concrete samples with both chemical and economical admixture after 7 days and 28 days.***
Keywords: Concrete, Admixtures, Slump test, Compressive strength.

I. INTRODUCTION

Concrete can be defined as the composite material composed of the binding medium such as the mixture of cement, water, and different fine and coarse aggregates. Concrete structures that have been built around the world are subject to a wide range of different conditions of use and acquaintance to environmental conditions comprising erosion, weather, and pollution. Concrete is an artificial composite material, comprising a matrix of cementitious binder (typically Portland cement paste or asphalt) and a dispersed phase or "filler" of aggregate (typically a rocky material, loose stones, and sand).

Admixtures are those ingredients in concrete other than Portland cement, water, and aggregates that are added to the mixture immediately before or during mixing. It is used to modify the freshly mixed, setting, or hardened properties and that is added to the batch before or during its mixing. Admixtures modify the properties of concrete or mortar to make them more suitable for the work at hand, or for economy, or for such other purposes as saving energy .Concrete admixtures are used to improve the behaviour of concrete under a variety of conditions and are of two main types: Chemical and Mineral.

In our work, we have studied the effects of a chemical admixture and an economical admixture that is easily available. The chemical admixture used is Sika admixture and for the economical one, we have used pieces of cement bags.

Fig. 1 Figure showing the concrete samples with chemical and economical admixture

II. LITERATURE REVIEW

1) Jagadale etal in 2021 carried out a research project is being carried out on structural grade concrete containing low cement and high volumes of admixtures (FLY ASH, GGGBS, RICE HUSK ASH) .Two batches of concrete were prepared: one without super plasticizer, one with super plasticizer. In this experimental work for each mix of composite, a total 33 specimen. For compressive strength test, 3 cube of each proportion having size 15X15X15. All above specimens were prepared with various Fly ash, GGBS, Rise Husk with replacement of cement by the 10 % - 30% of its weight .In most of the cases, compressive strength decreases with the increase in percentage of GGBS at early age but it increases with increase in percentage of GGBS at later ages. The Use of fly ash GGBS, Rise Husk in concrete up to 30% it didn't affect on compressive strength of concrete, it is a better replacement for cement in concrete because of its low cost.
2) Jain etal in 2019 carried out an experiment on concrete specimens by adding different types of admixtures. The admixtures used were- steel fiber, glass wool, SBR Latex and Rice straw and cement bag pieces. Compressive strength test was performed at 3 days, 7 days and 28 days As per the results steel fibre give more strength on the concrete but its cost is higher, so instead of steel fibre we can use the rice straw and pieces of cement bags and get enough strength. Here we are getting more strength than the require strength in M25 grade so we can reduce the grade like M15 and get the target strength.
3) Kumar etal in 2017 Fly ash and mineral powder are used for composite preparation of high strength lightweight aggregate concrete. The results shows, when we increase the percentage of the ground fly ash from 30% to 40% with 10%of Silica Fume the strength of concrete are increased. There is a decrease in the strength when 40% of Fly Ash is added with5 & 15% of Silica Fume. Excellent composite effect is shown when fly ash and mineral powder are combined together, the pozzolanic reaction more fully and the interface transition region between the lightweight aggregate and the cement paste solidifies further, which makes the structure of the lightweight aggregate concrete more compact.
4) Shekhar etal in 2020 examine the similarity and variation between concrete mix design by using the IS method and ACI method, also to suggest suitability of mix design through experimental investigation. In this research work 53 grade of OPC, locally available fine aggregate and coarse aggregate were selected, based on IS 456-2000 and IS 10262-2009 standards for determining quantities and proportion of concrete having grade M30. It was observed that water cement ratio was almost identical in the IS method and ACI method. The quantity of cement was highest used in IS method. Where, the percentage of FA was lowest in IS method and highest in ACI method. Compressive strength was determined at 7 days and 28 days curing period and finally, compared the results by checking strength and durability criteria.
5) Srikrishna etal in 2015 an attempt has been made to find out the strength of cement concrete containing Fly ash as a puzzolanic material. Manufactured sand and chemical admixture. Through standard parameters about 24% of cement is replaced by class F Fly ash, 100% replacement of Natural sand is done by Manufactured sand, SNF based Chemical admixture is added by 0.6% of cementitious materials and PCE by 0.5% of cementitious materials is added to the concrete to reduce the water content during the mix and to increase the strength parameters. Mix designs were made for M35 and M25 standard concrete mixes and their Strength parameters such as Compressive strength test, Flexural test and Test on cylinders were studied at 7, 28 and 56 days and Durability tests such as Acid test and Base test were studied at 56 days. Studies revealed that the cost whole Concrete mix will become economical than normal concrete mix. Comparing SNF and PCE, PCE in Concrete mix gave better results than SNF in almost every parameter.

III. METHODOLOGY

1) Preparation of M25 grade of concrete mix with two different types of admixtures:
- Chemical admixture i.e. Sika admixture
- Economical admixture i.e. by adding small pieces of cement bags

2) Conducting tests on fresh concrete of the above two samples: Slump test was conducted
3) Preparation of concrete cube specimens
4) Performing the compressive strength test of both the concrete samples after 7days and 28 days
5) Comparing the results obtained from the compressive tests after 7 days as well as 28 days and hence to find the most durable specimen.

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IV. EXPERIMENTAL WORKS PERFORMED

The following are the tests that were conducted on the prepared concrete cubes:

1) *Slump Test:* The concrete slump test measures the consistency of fresh concrete before it sets. It is performed to check the workability of freshly made concrete, and therefore the ease with which concrete flows. It can also be used as an indicator of an improperly mixed batch the test is popular due to the simplicity of apparatus used and simple procedure. The slump test is used to ensure uniformity for different loads of concrete under field conditions.

Fig. 2 Figure showing the slump test on fresh concrete

2) *Compressive Strength Test:* Compressive strength is the ability of material or structure to carry the loads on its surface without any crack or deflection. The compressive strength of the concrete cube test provides an idea about all the characteristics of concrete. By this single test one judge that whether Concreting has been done properly or not. Concrete compressive strength for general construction varies from 15 MPa (2200 psi) to 30 MPa (4400 psi) and higher in commercial and industrial structures.

V. RESULTS AND DISCUSSIONS

The results obtained after conducting slump test on fresh concrete and compressive strength test on hardened concrete are given in the following tables:

Specimen with chemical admixture	Compressive strength after 7 days, N/mm2	Compressive strength after 28 days, N/mm2
Specimen 1	16.4	24.4
Specimen 2	20.9	27.2
Specimen 3	14.6	29.2

Table 1- Table showing the after completing 7days and 28 days of chemical admixture sample

Specimen with economical admixture	Compressive strength after 7 days, N/mm2	Compressive strength after 28 days, N/mm2
Specimen 1	17.2	26
Specimen 2	16.4	26.4
Specimen 3	18.8	25.8

Table 2- Table showing the after completing 7days and 28 days of economical admixture sample

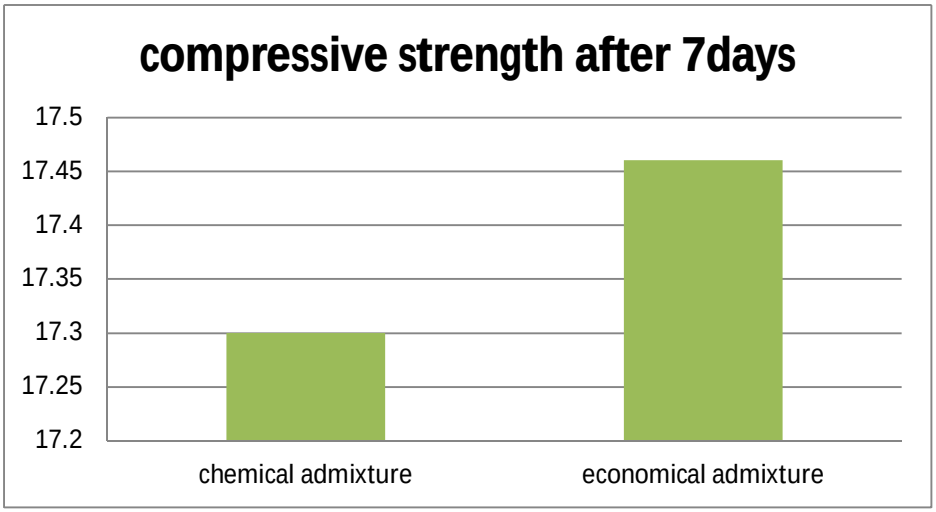

Figure4- figure showing compressing strength test after 7 days

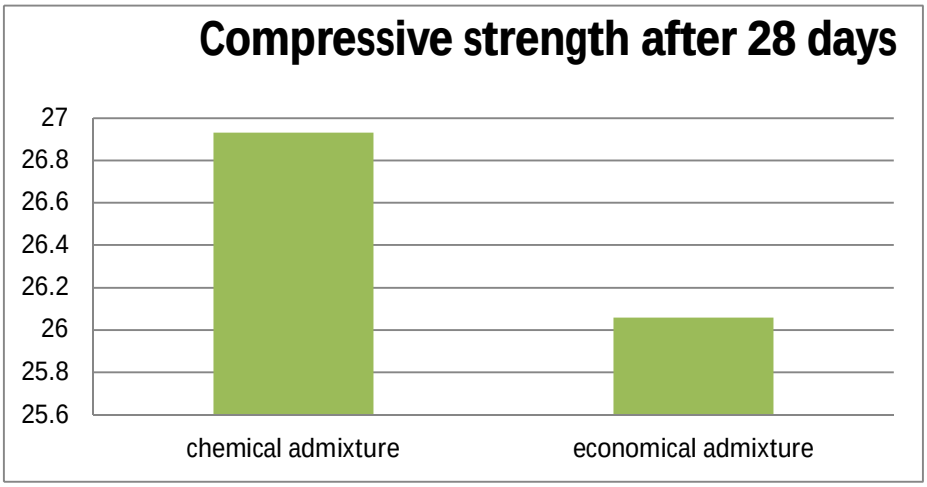

Figure5- figure showing compressing strength test after 28 days

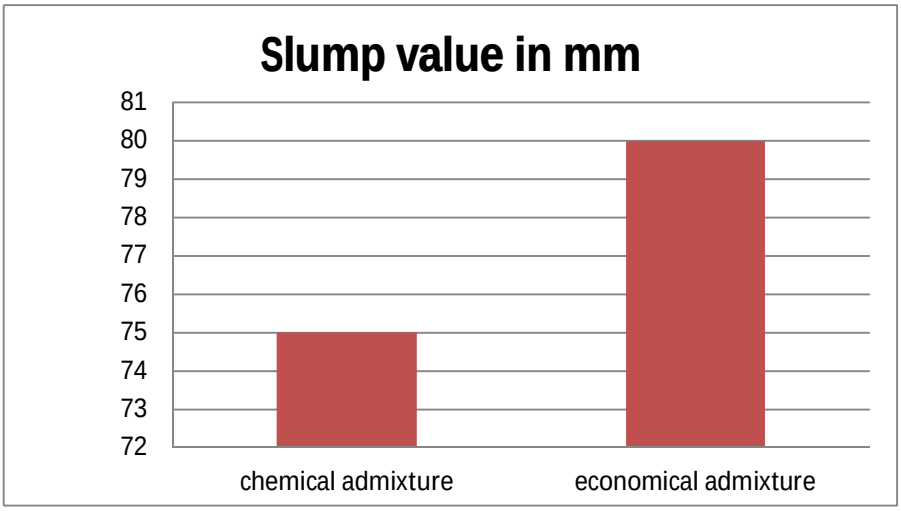

Figure6- figure showing slump values

VI. CONCLUSION

1) Based on the tests performed on both the types of specimens, it was observed that the specimen with economical admixture gained more strength than the chemical one in case of compressive strength after 7days by a difference of 0.16%. It was because of that the fact that the moulds in which the chemical admixture specimen was casted was not in proper shape.

2) However in case of test performed after 28 days, it was found that the specimen with chemical admixtures gained more strength than the economical one.

3) The slump value obtained in case of chemical was lower than that of economical admixture sample.

4) It was also observed that in terms of economy, the sample with economical admixture was much better than the other one and can be used in construction works as it gives almost the same compressive strength value as that of the concrete sample with chemical admixture.

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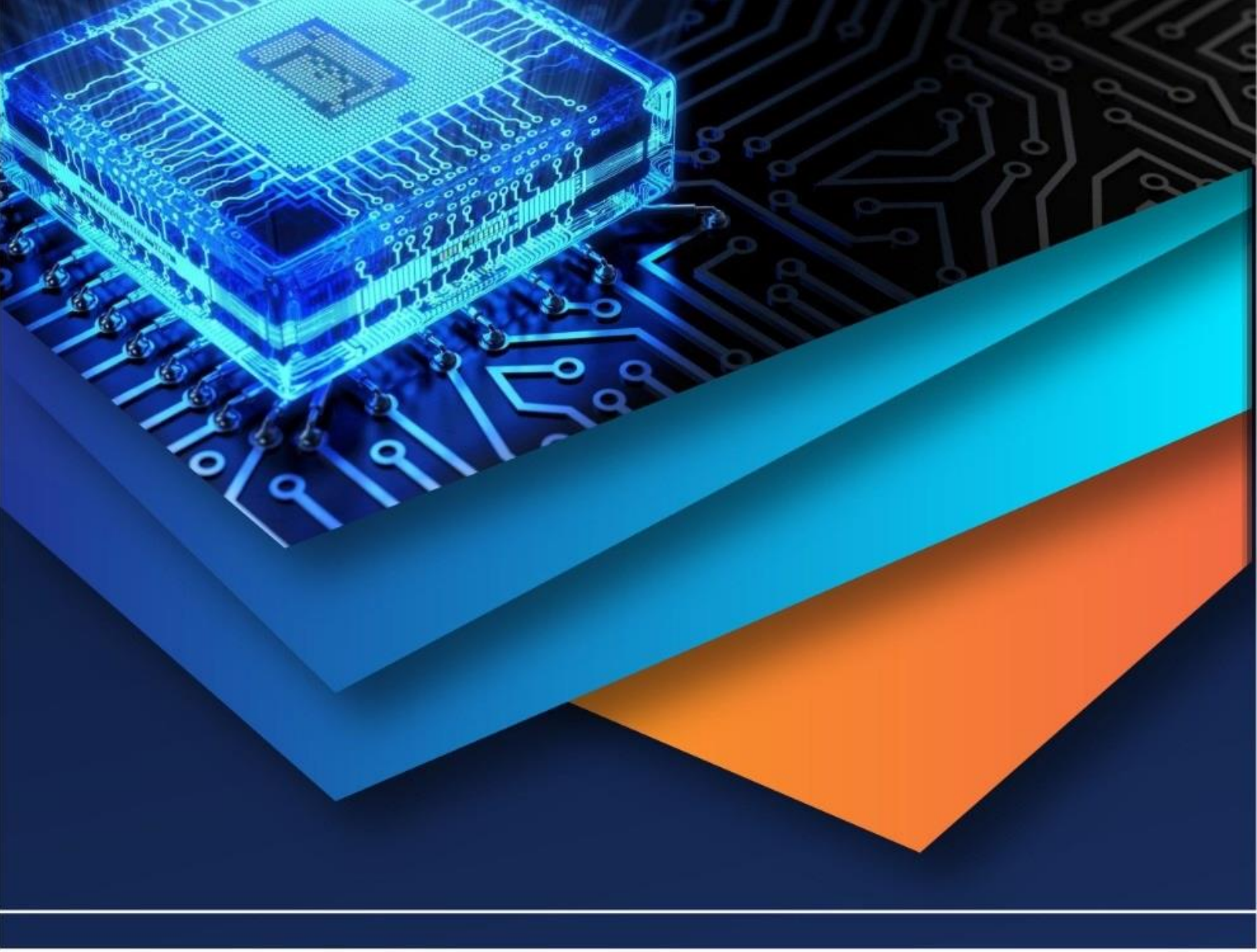

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