IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

STRENGTH STUDIES ON AR GLASS FIBER REINFORCED CONCRETE WITH SILICA FUME

[1]M. Chaitanya Nava kumar, [2]Dr. K.Chandramouli, [3]J.Sree Naga Chaitanya,[4]Dr.N.Pannirselvam,[5]V.Vijaya kanth.

[1&3]Assistant Professor, Department of Civil Engineering, NRI Institute of Technology, Visadala (V), Medikonduru (M), Guntur, Andhra Pradesh, INDIA.

[3] Professor & HOD, Department of Civil Engineering, NRI Institute of Technology, Visadala (V), Medikonduru (M), Guntur, Andhra Pradesh, INDIA.

[4]Associate Professor, Department of Civil Engineering, SRM Institute of Science and Technology, Kattankulathur, Chennai, Tamilnadu, India

[5]UG Students, Department of Civil Engineering, NRI Institute of Technology, Visadala (V), Medikonduru, (M), Guntur, Andhra Pradesh, INDIA.

Abstract: The world is developing rapidly due to the construction of buildings for commercial and residential. Due to the usage of concrete it leads to the shortage of the natural resources. Silica fume is added as admixture to partial replacement of cement with different percentages of 0, 5, 7.5 and 12.5. AR glass fibers are used to increase the mechanical properties of concrete. The test results were obtained with reference to compressive and split tensile strength at 28days. A constant percentage of 0.03% of glass fibers is added to the concrete.

Index Terms **- Alkaline glass fiber, silica fume, compressive strength, split tensile.**

I. INTRODUCTION

Concrete is the most generally utilized substance after water and more than six milliards huge an amount of cement is created every year. Concrete is explicit to various applications like new developments, fixes, recoveries and retrofitting. Solid structure segments in various sizes and shapes incorporate divider boards, doorsills, bar, columns and that's only the tip of the iceberg. Post-tensioned chunks are a preferred technique for mechanical, business and private floor piece development. It bodes well to characterize the utilization of cement based on where and how it is created, along with its technique for applications in these have diverse necessity and properties.

The interest for concrete is next just to water with the progression of innovation and expanded field of utilization of cement and mortars, different properties of the common cement required alteration to make it progressively appropriate for different circumstances, prudent and eco-friendly. This has prompted the utilization of cementitious materials.

A.R glass fiber are reinforced in conventional concrete with other chemical admixtures to developed is created is continuous fibers new composite material name as glass fiber reinforced concrete (GFRC) and which improves the performance of concrete. Due to the presence of discrete fibers, the cracking strength of concrete increases and fiber act as crack arresters.

Silica fume, also known as micro silica, it is an ultrafine powder collected as a by-product of the silicon and ferrosilicon alloy production and consist of spherical particles with an average particle diameter of 150mm. the main field of application is as pozzolanic material for high performance concrete.

II. OBJECTIVES

The objectives of this study are as follows

1. To optimize the usage of silica fume in concrete.

2. To evaluate the compressive and spilt tensile strength of concrete.

III. MATERIALS

The properties of cement are presented in Table 1.

Table 1 Physical properties of cement

S. No.	Property	Cement(53 grade)
1	Specific gravity	3.15
2	Fineness	3.5%
3	Consistency	30%
4	Initial setting time	32 min
5	Final setting time	510 min

3.1 Alkali resistant glass fiber

Alkali resistant (AR) glass fiber is glass fiber with added zirconium oxide to help resist attack from alkalinity. This is an important element of these fibers, as concrete is an alkaline environment. Normal fiberglass (E-glass) degrades in concrete due to the aggregate alkaline environment. AR fibers have been widely used in the concrete industry since the 1970's.

3.2 Silica fume

Waste can be used to produce new products or can be used as admixtures so that natural resources are used more efficiently and the environment is protected from waste. Silica fume is also known as micro silica or condensed silica fume, is used as an artificial pozzolanic admixture. It is a material resulting from reduction of quartz with coal in an electric arc furnace in the manufacture of silicon or ferrosilicon alloy. Chemical composition of silica fume contains more than 90 percent silicon dioxide other constituents are carbon, sulphur and oxides of aluminium, iron, calcium, magnesium, sodium and potassium. The physical composition of silica fume diameter is about 0.1 micron to 0.2 microns, specific surface area in the range of 13,000 to 30,000m^2/kg and density varies from 150 to 700 kg/m^3.

IV. EXPERIMENTAL INVESTIGATIONS

4.1 Compressive strength results

The compressive strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in table 2 to 4.

Table 2: Compressive strength of concrete with silica fume

S.No.	Silica fume, %	Compressive strength of concrete, N/mm^2	
		7 days	28 days
1	0	35.79	51.50
2	5	38.56	55.41
3	7.5	41.21	59.48
4	12.5	37.74	54.63

Table 3: Compressive strength of concrete with AR glass fibers

S.No.	Percentage of AR glass fibers	Compressive strength of concrete, N/mm^2	
		7 days	28 days
1	0	35.79	51.50
2	0.03	42.46	61.02

Table 4: Compressive strength of concrete with silica fume and AR glass fibers

S.No.	Percentage of AR glass fibers	Compressive strength of concrete, N/mm^2	
		7 days	28 days
1	0	35.79	51.50
2	7.5% SF + 0.03 AR glass fibers	46.15	65.01

4.2 Split tensile strength results

The split tensile strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in table 5 to 7.

Table 5: Split tensile strength of concrete with silica fume

S.No.	Silica fume, %	Split tensile strength of concrete, N/mm^2	
		7 days	28 days
1	0	3.47	5.00
2	5	3.70	5.37
3	7.5	4.23	6.06
4	12.5	3.29	4.91

Table 6: Split tensile strength of concrete with AR glass fibers

S.No.	Percentage of AR glass fibers	Split tensile strength of concrete, N/mm^2	
		7 days	28 days
1	0	3.47	5.00
2	0.03	4.07	5.90

Table 7: Split tensile strength of concrete with AR glass fibers and silica fume

S.No.	% of A+%SF	Split tensile strength of concrete, N/mm^2	
		7 days	28 days
1	0%AR+0%SF	3.47	5.00
2	0.03%AR+7.5%SF	4.52	6.37

V. CONCLUSION

1. At 7.5% SF, the compressive strength of concrete is 41.21 and 59.48N/mm^2 at 7 and 28 days.
2. For 0.03% AR glass fibers the compressive strength is 42.46 and 61.02N/mm^2 at 7 and 28 days.
3. With 0.03% AR glass fiber + 7.5% SF the maximum compressive strength is 46.15and 65.01N/mm^2 at 7 and 28 days.
4. At 7.5% SF, the split tensile strength of concrete is 4.23 and 6.06N/mm^2 at 7 and 28 days.
5. For 0.03% AR glass fibers the split tensile strength is 4.07 and 5.90N/mm^2 at 7 and 28 days.
6. With 0.03% AR glass fiber + 7.5% SF the maximum split tensile strength is 4.52and 6.37N/mm^2 at 7 and 28 days.

VI. REFERENCES

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BIOGRAPHIES

M. CHAITANYA NAVA KUMAR Assistant Professor in Civil Engineering at NRI Institute of Technology, Andhra Pradesh, India, he completed M. Tech in structural engineering from JNTUK. His research interests include concrete Technology and structural engineering. He is the author of over 10 papers in referred journals and International Conference including 1 paper. He is a member of M.I.S.T.E, IAENG.

"Dr. K. CHANDRAMOULI" Working as Professor & HOD Civil Engineering at NRIInstitute of Technology, Andhra Pradesh, INDIA. He completed Ph.D. from JNTU Hyderabad. His research interests include Concrete Technology and Structural Engineering. He published over 135 papers in various international journals and International Conferences, which includes 14 SCOPOUS INDEXED research papers. He received 5 International awards for his research in concrete technology. He is the member of WORLD RESEARCH COUNCIL, M.I.S.T.E., M.I.C.I., IAENG.

J. SREE NAGA CHAITANYA Assistant Professor in Civil Engineering at NRI Institute of Technology, Andhra Pradesh, India, she completed M. Tech in structural engineering from JNTUH. Her research interests include concrete Technology and structural engineering. She is the author of over 10 papers in referred journals and International Conference including 1 paper. She is a member of M.I.S.T.E, IAENG.

Dr. N. Pannirselvam working as Associate Professor in SRMIST, Kattankulathur, Tamilnadu, He completed Ph.D. from Annamalai University, Tamilnadu as full-time research scholar and has 15 years of teaching experience and 4 years in VIT University, Vellore. At presently guiding 7 PhD Scholars. His research interests include concrete composites, concrete materials and structural engineering. He published over 60 papers in various international journals. He has been serving as reviewer and editorial board member in reputed international journals.

VULLI VENKATA VIJAYAKANTH pursuing B. Tech in department of civil engineering NRI institution of technology.