An Experimental Study on Strength Properties of Concree with AR Glass Fibers under Different Methods

P.Raghavendrarao[1], Dr.K.Chandramouli[2]
1Assistant Professor, Dept of Civil Engineering, NRI Institute of Technology, Visadala(V), Medikonduru(M), Guntur, AP, India.
2HOD, Dept of Civil Engineering, NRI Institute of Technology, Visadala(V), Medikonduru(M), Guntur, AP, India.

Abstract

The Plain Concrete have weak nature and low elasticity. So putting of fortification bars to plain cement to accomplish the rigidity. Since Fiber Reinforced Cement is most generally utilized development materials. Fiber is effectively accessible material. Because of the Glass Fiber Reinforced Concrete the Glass Fiber effortlessly encompassed to the cementitious medium. The review work is centered around quality and toughness attributes of GFRC. According to IS 10262-2009 outlined by M30 review of Concrete and con plast as a super plasticizer and water bond proportion 0.43. The execution of Cement Concrete with changing rate of Glass Fiber including like 0.01%, 0.02%,0.03% and 1%. The quality and solidness properties of Glass Fiber Reinforced Concrete contrasted with Control Concrete.

KEYWORDS: AR Glass Fibers, Accelerated Curing, Normal curing, Ultasonic Pulse Velocity etc..

I. INTRODUCTION

Glass fiber has utilized more than 30 years in a few development components, predominantly non constructional ones, as façade boards, funneling for sanitation, enriching non recoverable frame work and different items. Cement is a standout amongst the most solid building materials. It gives prevalent imperviousness to fire contrasted and wooden development and additions quality after some time. Structures made of cement can have a long administration life. Cement is utilized more than some other artificial material on the planet Concrete, has moderately high compressive quality, yet much lower elasticity. Concrete has a low coefficient of warm development and therapists as it develops. Every single solid structure split to some degree, because of shrinkage and pressure. Glass fiber concrete (GFC) comprises fundamentally of a network made out of bond, sand, water, and admixtures, in which short length glass filaments are scattered. The impact of the strands in this composite prompts an expansion in the strain and effect quality of the material. Glass fleece, which is regularly known as "fiberglass" today, be that as it may, was created in 1938 by Russell Games Slayter of Owens-Corning as a material to be utilized as protection. It is advertised under the exchange name Fiberglass, which has turned into a summed up trademark. It is material produced using greatly fine strands of glass. Fiberglass is a lightweight, to a great degree solid, and powerful material. In spite of the fact that Its mass quality and weight properties are additionally extremely ideal when contrasted with metals, and it can be effectively shaped utilizing forming forms. Glass is the most seasoned, and most commonplace, execution fiber.

II. LITERATURE REVIEW

Kenneth W. Stier and Gary D. Weede [1] examined the achievability of reusing intermixed plastics Fiber in Concrete. It was found that the mechanical properties of cement, for example, compressive and flexural quality indicated change yet however the strength angle was sketchy.Antonio Nanni [2] everywhere on that the cacophonic tension check may well is wont to affirm the lastingness of fiber cement unremarkably acquired with static flexural check. Also it had been everywhere on that calculation of beginning break and preeminent split is extra helpful than that of flexural or direct strain check.Mohamed S. Issa, Ibrahim M.Metwally, Sherif M. Elzeiny[3] Fiber-strengthened polymer (FRP) bars can be utilized to supplant steel support ordinary steel has the characteristic issue of erosion accordingly of which it experiences development and solid breaking may happen; in this way FRP rebar might be utilized as a substitute. The utilization of these filaments avoids the issue of consumption and builds the flexibility of the FRP-fortified solid pillars yet the heap diversion was observed to be higher. Sekar[4] examined on fiber strengthened cement from modern machine waste and wire winding waste and found that this waste essentially enhanced the compressive, split-rigidity and the flexural quality estimations of cement. It additionally expressed that wire drawing industry

squander diminished the quality qualities. Balaguru and Ramakrishnan [5] presumed that underlying and last setting times of plain and fiber fortified cements were the same. Fiber concrete had bring down droop and air-content and the rate of loss of these parameters with time was additionally higher. It was additionally watched that shrinkage of fiber cement was somewhat less yet it experienced marginally more crawl disfigurements. In the range of air void attributes , the particular surface of air air pockets was lower for Fiber fortified cement.Bentur[6] announced that the utilization of salt safe glass filaments with silica smoke was successful in enhancing sturdiness execution of salt safe glass fiber strengthened concrete composites (GFRC). Discoveries concerning smolder substitution in the grid and toughness execution were additionally talked about. It was recommended that fiber use takes out the maturing actuated by microstructural impacts, while the lattice adjustment decreases the impact of concoction assault

III. MATERIALS USED

Cement: In our work Ordinary Portland concrete (OPC) - 53 review Nagarjuna Cement was utilized. Fine and coarse aggregate: Fine aggregate of Zone II from Krishna River, Amaravathi, Guntur (dt) and coarse aggregates of sizes 20 mm from Balaji stone crusher industry, Perecherla, Guntur

IV. AR GLASS FIBERS

Ar glass fibers from chemzest enterprises and suppliers from Chennai

Fig1: AR Glass Fibers

Table 1PROPERTIES OF AR GLASS FIBERS

Physical values	Recommended values
Specific gravity	2.67
Elasticity modulus	72
Tensile strength	1700
Length	6mm

V.TESTING METHODS

Casting of Cubes and Cylinders

Solid blend is set up according to the rules of IS 456:2000. The size picked was one of the standard sizes said in the code. The sizes were 150*150mm and 300*150mm. The solid examples were set up from a blend of Ordinary Portland concrete, characteristic totals and in the wake of throwing, examples were vibrated. The examples were single layered and outmost care was taken to set them up so that thickest and the specimen when thought about did not surpass 10% of the base thickness. The blend was set up by machine and afterward the blend arranged was poured in the molds each one in turn and afterward first they were hand compacted after that vibrated on the vibrator table. The surface completing was finished by utilizing a completing trowel. Subsequent to pouring in the molds and compacting on the vibrator table the molds were put down at first glance and permitted to set for 24hrs.

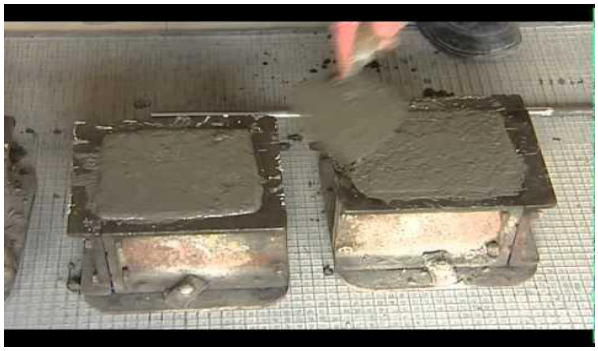


Fig2. Cubes casting

Fig3. Cylinders casting

VI. EXPERIMENTAL SETUP

Different tests led on the examples are depicted underneath alongside the portrayal and significance. There were two courses in which the examination was completed one in which just shapes and chambers were threw and the review of cement was M-30. The ostensible most extreme size of total was 20mm and no admixture was utilized.

Ultrasonic Pulse Velocity Test

The UPV test is a non-damaging test and is shrouded in IS 13311 (Part 1)–1992.Itgives a measure of the nature of cement. The technique comprises of measuring the season of go of a ultrasonic heartbeat going through the solid being tried. Nearly higher speed is gotten when solid quality is great as far as thickness, consistency, homogeneity and so forth. To begin with couplant is connected to the surfaces of the transducers and squeezed hard onto the surface of the material. The transducers are not moved while a perusing is being taken, as this can produce clamor signs and mistakes in estimations. The transducers are constantly clutched the surface of the material until a steady perusing shows up on the show, which is the time in microsecond for the ultrasonic heartbeat to venture to every part of the separation 'L'.

The mean estimation of the show readings is taken when the unit's digit hunts between two qualities. The speeds got can be deciphered as nature of cement and not in type of the review of cement.

Pulse velocity= (Path length/Travel time)

Fig4. Ultrasonic pulse velocity equipment

Table Standard values of Ultrasonic Pulse Velocity

S NO	PULSE VELOCITY	CONCRETE QUALITY
1	Above 4.5	Excellent
2	3.5 to 4.5	Good
3	3 to 3.5	Medium
4	Below 3.0	Doubtful

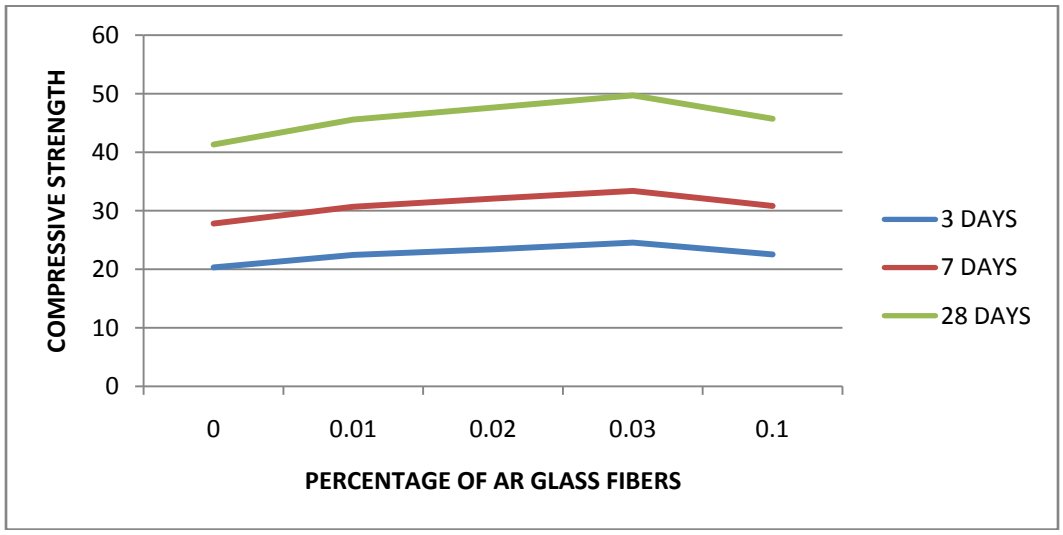
VII. RESULTS

1. COMPRESSIVE STRENGTH OF M30 CONCRETE

A. Normal Curing

S.NO	% OF AR GLASS FIBERS	3 DAYS	7 DAYS	28 DAYS
1	0	20.33	27.82	41.32
2	0.01	22.46	30.70	45.57
3	0.02	23.41	32.08	47.62
4	0.03	24.57	33.40	49.70
5	0.1	22.54	30.82	45.71

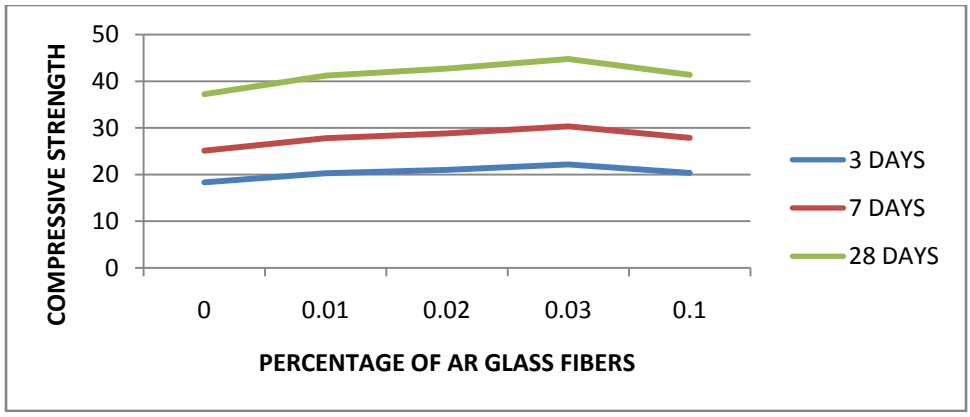
The compressive strength of different ages were calculated and tabulated and also plotted graph in that shows that the increase in compressive strength up to addition of 0.03% of fiber content



B. Gunny bag curing

S.NO	% OF AR GLASS FIBERS	3 DAYS	7 DAYS	28 DAYS
1	0	18.32	25.11	37.24
2	0.01	20.28	27.79	41.22
3	0.02	21.01	28.80	42.71
4	0.03	22.16	30.32	44.76
5	0.1	20.34	27.84	41.36

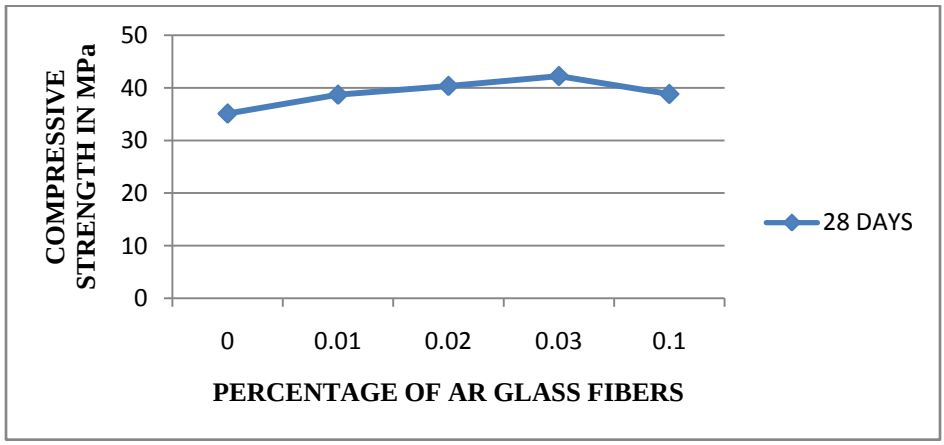
The compressive strength of different ages were calculated and tabulated and also plotted graph in that shows that the increase in compressive strength up to addition of 0.03% of fiber content



C. Accelerated curing

S.NO	% OF AR GLASS FIBERS	28 DAYS
1	0	35.12
2	0.01	38.70
3	0.02	40.36
4	0.03	42.24
5	0.1	38.83

The compressive strength for 28 days were calculated for the accelerated curing method and tabulated and also plotted graph in that shows that the increase in compressive strength up to addition of 0.03% of fiber content

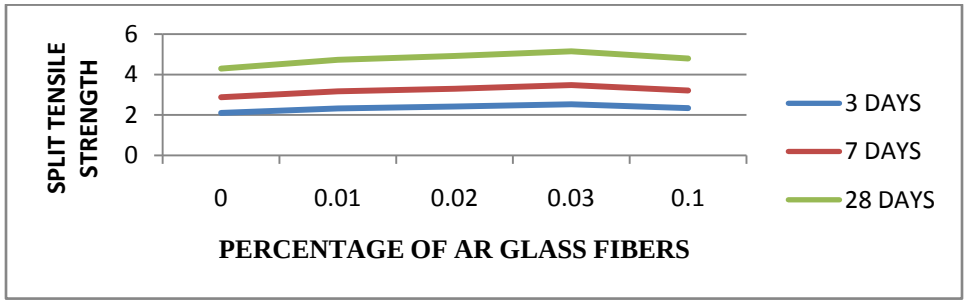


2. SPLIT TENSILE STRENGTH OF M30 CONCRETE
A.NORMAL CURING

S.NO	% OF AR GLASS FIBERS	3 DAYS	7 DAYS	28 DAYS
1	0	2.104	2.88	4.29
2	0.01	2.325	3.17	4.73
3	0.02	2.416	3.30	4.92

4	0.03	2.526	3.48	5.15
5	0.1	2.34	3.21	4.79

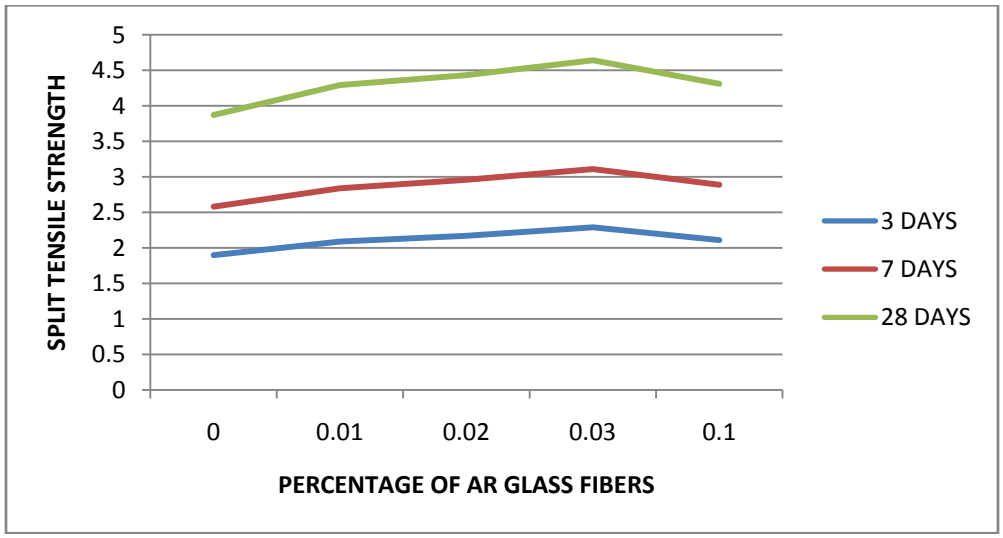
The split tensile strength of different ages were calculated and tabulated and also plotted graph in that shows that the increase in compressive strength up to addition of 0.03% of fiber content



B. GUNNY BAG CURING

S.NO	% OF AR GLASS FIBERS	3 DAYS	7 DAYS	28 DAYS
1	0	1.897	2.58	3.87
2	0.01	2.09	2.84	4.29
3	0.02	2.17	2.96	4.43
4	0.03	2.29	3.11	4.64
5	0.1	2.11	2.89	4.31

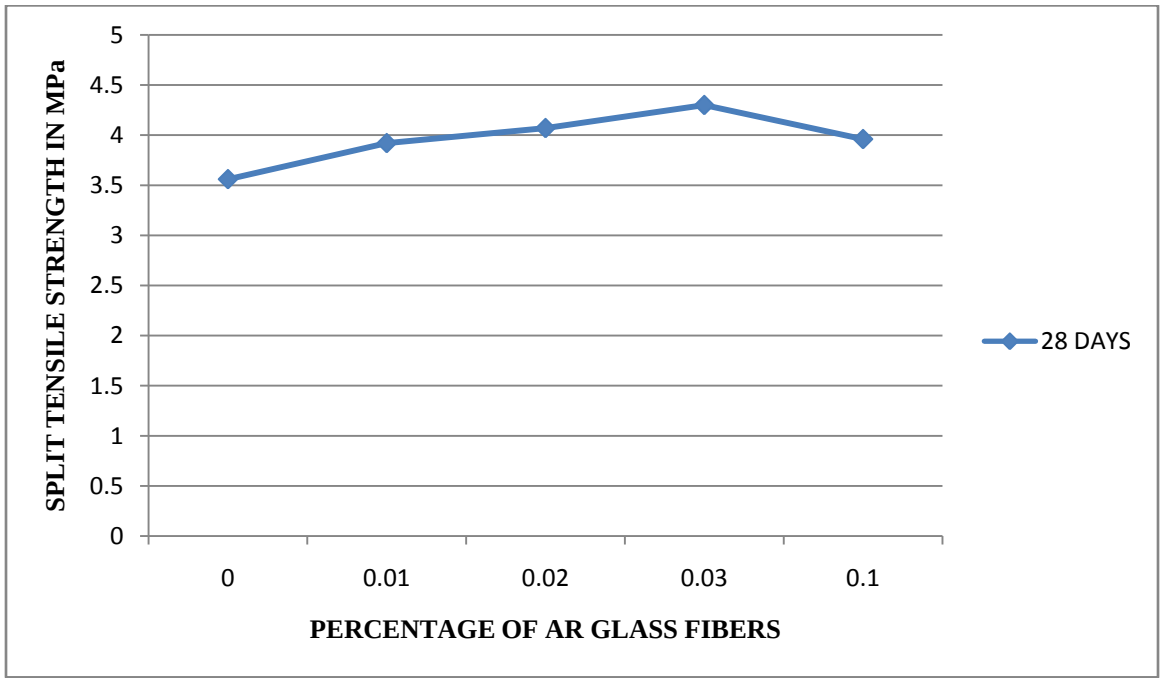
The split tensile strength of different ages were calculated for the gunny bag curing method and tabulated and also plotted graph in that shows that the increase in compressive strength up to addition of 0.03% of fiber content



C. ACCLERATED CURING

S.NO	% OF AR GLASS FIBERS	28 DAYS
1	0	3.56
2	0.01	3.92
3	0.02	4.07
4	0.03	4.30
5	0.1	3.96

The split tensile strength was calculated for 28 days to the accelerated curing method. The table shows the increase in the tensile strength up to 0.03% of fiber content .the graph also plotted



3. ULTRASONIC PULSE VELOCITY OF CONCRETE SPECIMENS

. Ultra Pulse Velocity Results of Concrete Specimens

S NO	% AR glass fibers by weight	Obtained average velocity	Quality of Concrete
1	0	3923	Good
2	0.01	4156	Good
3	0.02	4298	Good
4	0.03	4574	Excellent
5	0.1	4134	Good

UPV test was completed on the solid examples and the normal estimations of the speeds which were not fluctuating over 15% are accounted for and the suggestions are appeared previously

VIII. RESULTS

In this exploratory program the impact of short discrete soluble safe (AR) glass filaments on the compressive and split rigidity of cement was considered.
The impact of glass filaments on bond and solid examples which are created by vibration strategy are likewise considered. The properties considered are compressive quality, wet transverse quality and water assimilation .The solid blend gets harsher and less workable with increment of fiber substance along these lines utilization of admixture end up plainly essential. However even subsequent to giving measurement of admixture as high as 1.5% appropriate workability couldn't be acquired and some isolation was watched. However in this review the fiber substance is constrained to 0 % to 0.10 % of AR glass filaments.
The different perception in view of the trial result are as per the following:

1. The compressive quality of cement without admixture is not influenced by the nearness of short discrete glass strands with fiber content in the range 0 to 0.1 % of fiber substance by weight of cement.
2. The split rigidity of solid increments with the expansion of glass filaments.
3. The water retention of the solid additionally diminishes with increment in fiber content.
4. The compressive quality of cement with admixture was not influenced up to 0.03 % fiber content but rather diminished with the nearness of higher measure of filaments.
5. The accelerated curing methods gives good results up to 0.03% fiber content
6. The ultra pulse velocity gives the excellent grade of concrete under 0.03%fiber content
7. From this review I can infer that the utilization of AR glass strands up to 0.03% can build the quality of cement and past that rate of filaments the quality of solid reductions.

ACKNOWLEDGEMENT

I express my gratitude towards my guide **Dr.K.CHANDRAMOULI M.Tech(struct),Ph.D,,** Head of Civil Engineering Department, NRI INSTITUTE OF TECHNOLOGY, Visadala(V) for his guidance,valuable support and inspiration, constant encouragement throughout this Dissertation.

I express my sincere thanks to lab technician of Structural Engineering Laboratory for his kind help and co-operation during my work.

I sincerely thanks to my colleagues and Friends for their kind help and co-operation during my experimental work.

I also express my deepsense of gratitude and indebtedness to my esteemed Institute, , NRI INSTITUTE OF TECHNOLOGY, Visadala(V)which has provided me an opportunity to fulfill the most cherished desire to reach my goal.

IX. REFERENCES

[1] Chandramouli, K, Srinivasa Rao, P, Pannirselvam, N, Seshadri Sekhar,T, and Sravana, Priyadrashini, T .P, (2010), " Strength and durability characteristic of glass fibre concrete", International Journal of Mechanics of Solids,Vol. 5, No.1, pp. 15-26
[2] Alan J. Brookes, "Cladding of Buildings", Third Edition Published 2002, (pp 82).
[3] Arnon Bentur and Sidney Mindess, "Fibre Reinforced Cementetious Composites", Second Edition 2007, Chapter 8, (pp278).
[4] J.G. Ferreira, F.A. Branco 2005, "Structural application of GRC in telecommunication towers", Construction and Building Materials Journal, Published August 2005.
[5] Majumdar, A.J. (1974), "The role of the interface in glass fibre reinforced cement", Building Research Establishment, Published 1974, Current Paper (cp 57- 74).
[6] M. Levitt 1997 "Concrete materials problems and solutions", "GRC and Alkali-Glass reaction", First Edition 1997, (pp 22-24).
[7] M.W. Fordyce and R.G. Wodehouse, "GRC and buildings", Published First Edition 1983.
[8] Perumelsamy N. Balaguru and Surendra P. Shah, "Fibre reinforced cement composites", February 1992, Chapter 13, (pp351).
[9] Dr. P. Perumal and Dr. J. Maheswaran, "Behavioural study on the effect of AR-Glass Fibre reinforced concrete", NBW & CW October 2006, (pp 174-180).
[10] R .N. Swamy, "Testing and Test Methods of Fibre Cement Composites", Published 1978, (pp 42-43).
[11] Surendra P. Shah, James I. Daniel, Darmawan Ludirdja, "Toughness of Glass Fiber reinforced concrete panels subjected to accelerated aging", PCI Journal, September-October 1987, (pp 83-88).
[12] U. M. Ghare, "Manufacture of Glass Fibre Reinforced Concrete Products", Unit 1, Division of YOGI group-UAE, August 2008.
[13] Bentur, A, and Kovler, K, (1997) "Durability of some glass fibre reinforced cementations composites", Fifth International Concrete on Structural Failure, Durability Retrofitting, Singapore, November 27- 28,pp. 190- 199.
[14] Banthia, N, Yan, C.B, Lee W.Y, (1997) "Restrained shrinkage cracking in fiber feinforced concrete with polyolefin fibres", Fifth International Concrete on Structural Failure, Durability Retrofitting, Singapore, November 27-28, pp. 456-463.