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Experimental Investigation on concrete by using various Fibres and Minerals

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ABSTRACT
High performance Concrete is fastgetting acceptability for a wide range of applications in the construction of concrete structures. specific application and having advantageous properties like strength, high durability and high constructability has compared to the conventional type of normal strength concrete. To produce such a high performance concreteminerals like silica fume, linseed oil and fibers like polypropylene, coconut fiber are used along with normal ingredient in the use of mineral admixtures in concrete enhances its properties regarding strength, durability, workability. The scope of the present study is to investigate the effect of mineral admixtures such as silica fume, linseed oil, polypropylene.The compressive strength of high performance concrete with mineral admixtures at the replacement level of 3 and 5% were study at 7 and 28 days of curing. From the studies conducted the silica fume and polypropylene play a vital role in improving the strength of concrete particularly at early ages. From the durability point of view, all the two mineral & fibers perform well. But the drying shrinkage was morein silica fume mortar than in linseed oil, coconut fiber and polypropylene mortar.

1.INTRODUCTION

Concrete is the mostly widely used manmade construction material in the world.It is obtained by mixing cementitious material, water, aggregate in required proportions. Cement is the most important constituent material, since it binds the aggregate and resists the atmospheric action. It is difficult to maintain strength of concrete and increase its durability.

The mixture when placed forms and allowed to cure hardness into a rock like mass known as concrete.It has high compressive strength and low tensile and flexural strengthened to develop the tensile stresses the concrete is strengthened by the steel bars called reinforced cement concrete. So the addition of natural fibers is economical way to increase strength of concrete. The type of fibers currently been used include steel, glass, polymers, carbon and natural fibers.

The reinforced concrete is used throughout the world to build infrastructure and building. Today, the large numbers of civil infrastructures around the world in a state of serious deterioration due to carbonation, chloride attack, etc.Corrosion of reinforcement is the principal cause of deterioration of structural concrete and a major economic cost for maintenance of national infrastructures.

The effect of this deterioration on residual capacity is therefore a matter of concern to those charged with ensuring safe operation of concrete structures.It is clear, however, that many reinforced concrete structures remain in service once reinforcement has started to corrode and cover concrete over the bars has began to spall, there is extensive evidence that modest amounts of corrosion do no pose an appreciable threat to structural stability.

It is essential that responsible engineers have at their disposal the means to verify that the affected structures retain an acceptable margin of safety.Corrosion may affect residual capacity through several mechanisms, including loss of bar section, loss of concrete section as a result of longitudinal cracking and spalling and a reduction in the interaction, or a bond, between the reinforcement and the concrete.Steel reinforcement is very effectively protected from corrosion by good quality of concrete, adequate thickness of cover and high alkalinity of the concrete. But due to various factors, the passive state of steel is lost and it belongs to corrode.

1.1 OBJECTIVE

1) To find out the comparison of minerals and fibers on various strength andcorrosion properties of concrete.
2) To analysis the specimens for 3% and 5% for strength and corrosion
3) To determine the various strength of concrete for compressive strength,tensile strength & flexural strength of concrete.

1.2 SCOPE

1) To make the concrete corrosion resistance and also to increases the strength in concrete by comparing thetwo minerals and fibres.
2) The use of coconut fibres, polypropylene ,silica fume and linseed oil increase the strength.
3) The purpose this project is to determine the feasibility of using fiber and mineral in the concrete

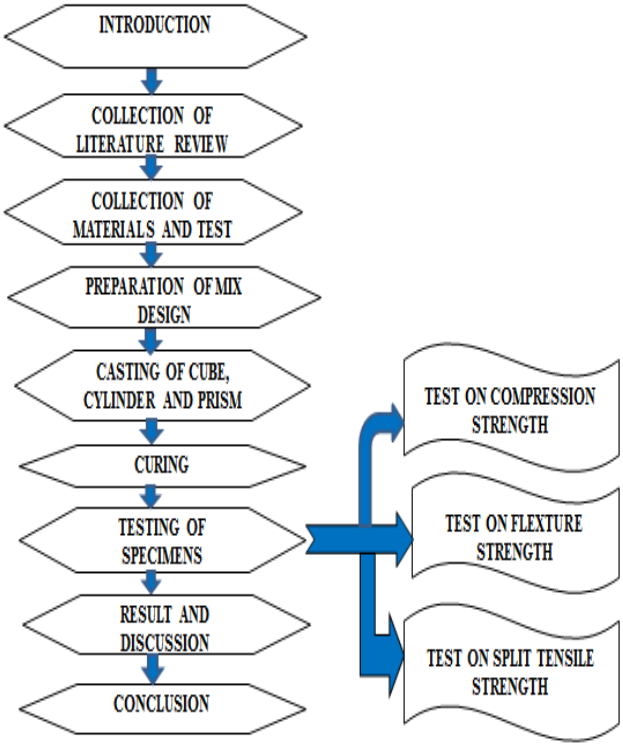
1.3 ADVANTAGES

1) Corrosion resistance,
2) High Workability.
3) Increases the strength of the concrete.
4) Increases the Permeability of the Concrete.

1.4 DISADVANTAGES

1) The strength is loss
2) Important properties of iron may be lost
3) It greatly affects normal iron by means of corrosion

2.METHODOLOGY



3. MATERIALS

3.1 Cement

Portland Pozzolana Cement also commonly known as PPC cement.The percentage of pozzolanic material used in the preparation should be between 10 to 30%.

Table 1: Physical Properties of Cement

S.no	Tests	Results
1.	Standard Consistency	29%
2.	Initial Setting Time	40 minutes
3.	Specific gravity	2.95
4.	Fineness	7%

3.2 Aggregates

The m-sand is used as fine aggregate conforming to the requirements of IS :383 -1970.Coarse aggregate obtained from local quarry units has been used for this study, conforming to IS :383 -1970.

Table 2: Test results of M-sand

S.no	Tests	Results
1.	Specific gravity	2.75
2.	Water Absorption	1.25%
3.	Fineness Modulus	3.68%

Table 3: Test results of coarse aggregate

S.no	Tests	Results
1.	Specific gravity	2.80
2.	Water Absorption	0.15%
3.	Fineness Modulus	6.02%
4.	Impact Value	12.16%

3.3 Coconut Fibre

Addition of coconut fibres improved the flexural strength of concrete ,they also formed good bonding in the concrete .the study found about the optimum fibre content to be 3 %

Table 4: Dimensions of coconut fibre

Dimensions	Value (mm)
Length	50
Diameter	0.20

3.4 Silica Fume

It is fine product obtain from by-product of silicon and ferro silicon alloy product and consist of spherical shape particles.
3.4 Concrete mix proportion.

Table 5: Physical Properties of Silica fume

S.no	Description	Properties
1	Form	Ultra fine amorphous powder
2	colour	White
3	Particle size	15µm
4	SiO_2	99.89%

3.5 Polypropylene

Polypropylene fibres are light weight synthetic fibre obtain as a by-product from textile industry. It prevent crack formation and provide reinforcement to the concrete structure.

Table 6: Physical Properties of polypropylene

S.no	Description	Properties
1.	Size	12mm
2.	Material	100% polypropylene
3.	Chemical Composition	C-33% ,H-67%

3.6 Linseed oil

Linseed oil is an effective and affordable concrete floor sealant.it works well to seal moisture and make concrete harder.

Table 7: Physical properties of linseed oil

S.no	Description	Characteristics
1.	Appearance	Clear to yellow liquid
2.	Density	0.995 g/cm^3
3.	Viscosity	325 Mpa

4. MIX DESIGN

a) Mix design

The process of selecting suitable ingredients of concrete and determiningtheir relative amounts with the objective of producing a concreteof the requiredstrength, durability and workability as economically as possible is termed as concrete mix design.

b) Mix proportion

Table 8 : Mix proportion

Ingredients	Mixes (3%)				
	M0	M1	M2	M3	M4
Cement (kg/m$^{3)}$	420	352	352	352	352
Coconut Fibre	-	10.56	-	-	-
Polypropylene	-	-	10.56	-	-
Silica Fume	-	-	-	10.56	-
Linseed Oil	-	-	-	-	10.56
Water (litres/m$^{3)}$	197	158	158	158	158
Coarse Aggregates (kg/m$^{3)}$	986	1128.6	1128.6	1128.6	1128.6
Fine Aggregates (kg/m$^{3)}$	752	866.8	866.8	866.8	866.8

Table 9 : Mix proportion

Ingredients	Mixes (5%)				
	M0	M1	M2	M3	M4
Cement (kg/m$^{3)}$	420	352	352	352	352
Coconut Fibre	-	17.6	-	-	-
Polypropylene	-	-	17.6	-	-
Silica Fume	-	-	-	17.6	-
Linseed Oil	-	-	-	-	17.6
Water (litres/m$^{3)}$	197	158	158	158	158
Coarse Aggregates (kg/m$^{3)}$	986	1165.0	1165.0	1165.0	1165.0
Fine Aggregates (kg/m$^{3)}$	752	863.22	863.22	863.22	863.22

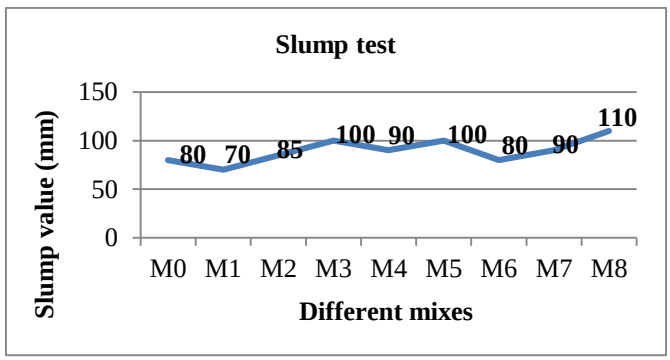
5.RESULTS AND DISCUSSIONS

a) Slump test

Slump test is used to determine the workability of fresh concrete. Slump test as per IS 1199-1959 is followed.

Table 10 : Slump Values of different mix proportion

S.no	Mix Designation	Proportion	Slump Value (mm)
1	M0	100% PPC	80
2	M1	100% PPC + 3% coconut fiber	70
3	M2	100% PPC + 3% polypropylene	85
4	M3	100% PPC + 3% Silica Fume	100
5	M4	100% PPC + 3% l.inseed oil	90
6	M5	100% PPC + 5% coconut fiber	100
7	M6	100% PPC + 5% polypropylene	80
8	M7	100% PPC + 5% Silica Fume	90
9	M8	100% PPC + 5% l.inseed oil	110



Graph 1: Slump Value Test

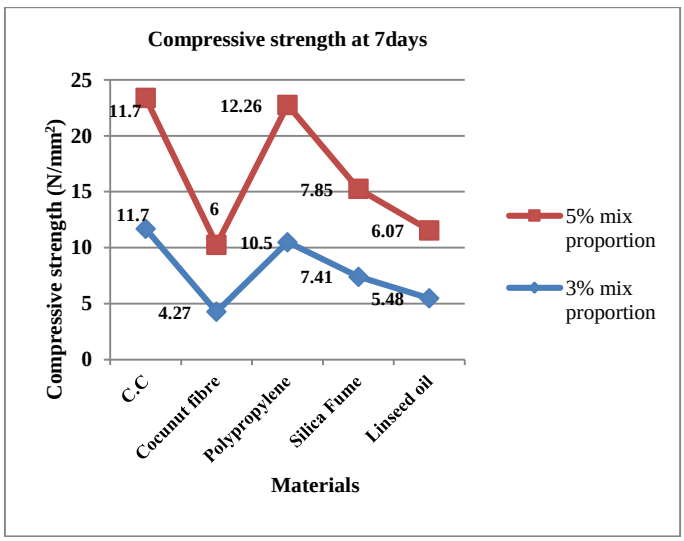
b) Compressive strength

Compressive strength test is done as per IS 516- 1959.

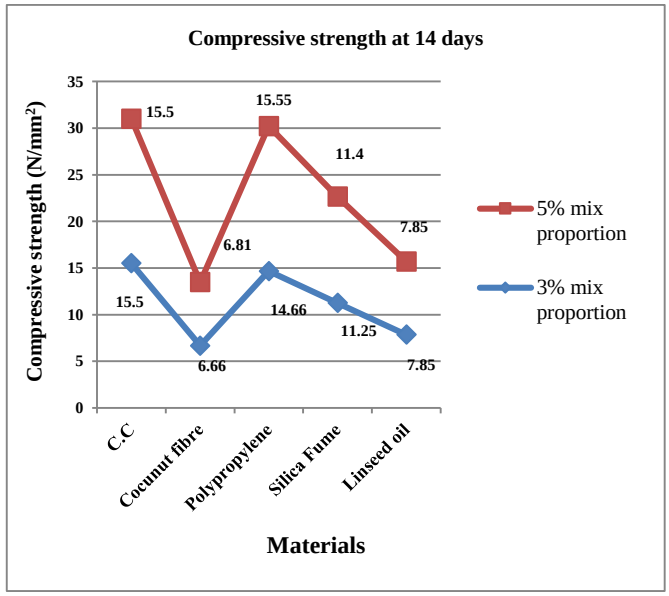
Fig 1: Testing of Compressive strength for concrete

Table11: Compressive strength at 7, 14, 28 days for (3 & 5%)

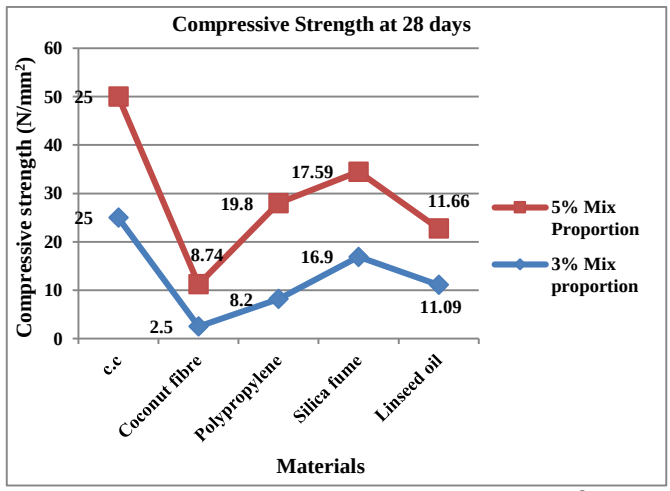
S. no	Mix	Proportion	Compressive strength(N / mm²)		
			7 Days	14 Days	28 Days
1	M0	100% PPC	11.7	15.5	25
2	M1	100% PPC + **3%** coconut fiber	4.27	6.66	8.2
3	M2	100% PPC + **3%** polypropylene	10.5	14.66	18.5
4	M3	100% PPC + **3%** Silica Fume	7.41	11.25	16.9
5	M4	100% PPC + **3%** linseed oil	5.48	7.85	11.09
6	M5	100% PPC + **5%** coconut fiber	6.07	6.81	8.74
7	M6	100% PPC + **5%** polypropylene	12.26	15.55	19.8
8	M7	100% PPC + **5%** Silica Fume	7.85	11.4	17.59
9	M8	100% PPC + **5%** l.inseed oil	6.07	7.85	11.66



Graph 2: Compressive Strength at 7 days in N/mm²



Graph 3: Compressive Strength at 14 days in N/mm²



Graph 4: Compressive Strength at 28 days in N/mm²

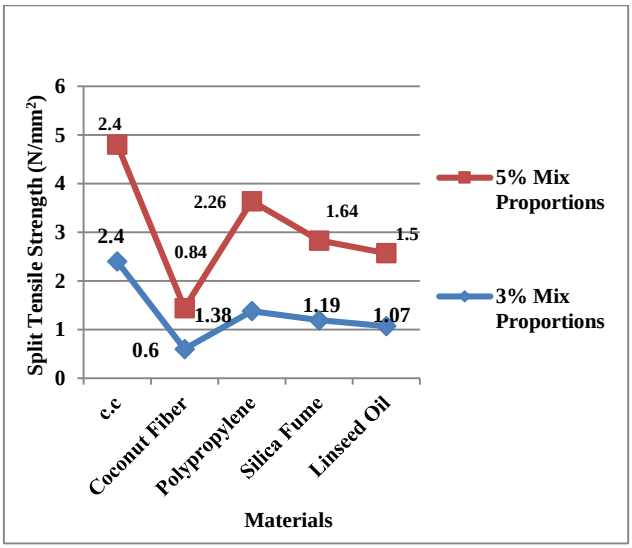
c) Split Tensile Strength

The tensile strength of concrete is one of the basic and important properties. Splitting tensile strength on concrete is a method to determine the tensile strength of concrete.

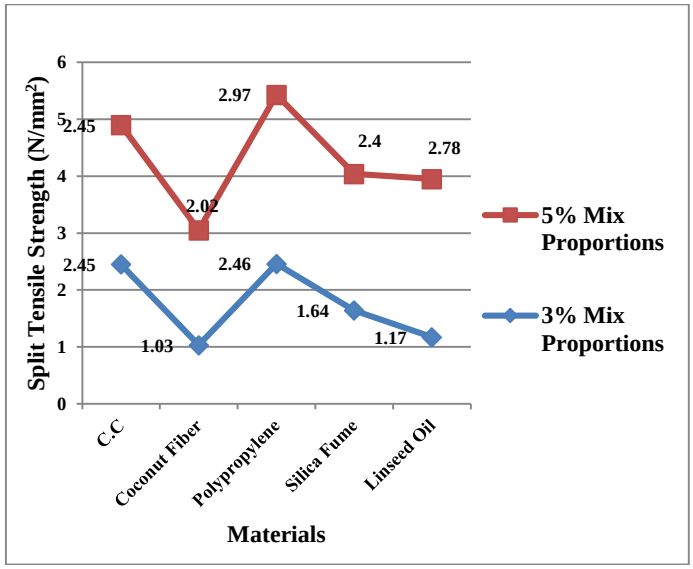
Fig 2: Split Tensile strength Test

Table12 : Split tensile strength at 7, 14, 28 days for (3 & 5%)

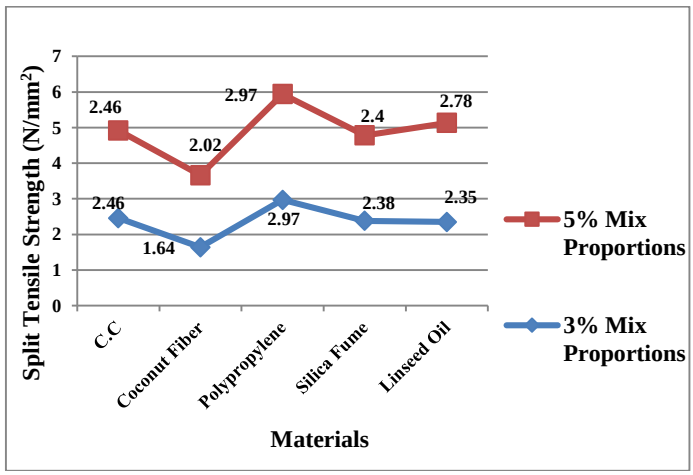
S.no	Mix	Proportion	Split tensile strength (N / mm^2)		
			7 Days	14 Days	28 Days
1	M0	100% PPC	2.4	2.45	2.46
2	M1	100% PPC + **3%** coconut fiber	0.60	1.03	1.64
3	M2	100% PPC + **3%** polypropylene	1.38	2.46	2.97
4	M3	100% PPC + **3%** Silica Fume	1.19	1.64	2.38
5	M4	100% PPC + **3%** linseed oil	1.07	1.17	2.35
6	M5	100% PPC + **5%** coconut fiber	0.7	0.84	2.02
7	M6	100% PPC + **5%** polypropylene	1.60	2.26	2.97
8	M7	100% PPC + **5%** Silica Fume	1.13	1.64	2.4
9	M8	100% PPC + **5%** l.inseed oil	2.82	1.50	2.78



Graph 5: Split Tensile strength at 7 days in N/mm^2



Graph 6: Split Tensile strength at 14 days in N/mm^2



Graph 7: Split Tensile strength at 28 days in N/mm^2

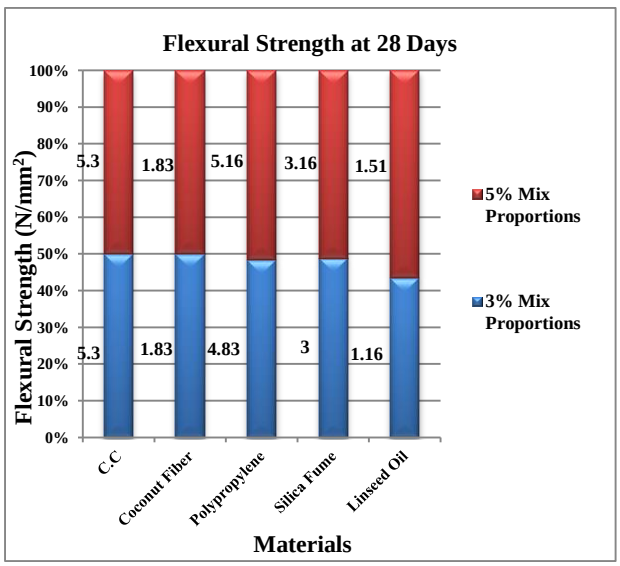
d) Flexural Strength

Flexural strength of concrete also known a modulus of rupture or bend strength is a material property defined as the stress in a material just before it yields in a flexure test.

Fig 3: Testing of Flexural strength for concrete

Table 13: Flexural strength at 28 days for (3 & 5%)

S.no	Mix	Proportion	Flexural strength(N/mm^2)
			28 Days
1	M0	100% PPC	2.46
2	M1	100% PPC + 3% coconut fiber	1.64
3	M2	100% PPC + 3% polypropylene	2.97
4	M3	100% PPC + 3% Silica Fume	2.38
5	M4	100% PPC + 3% linseed oil	2.35
6	M5	100% PPC + 5% coconut fiber	2.02
7	M6	100% PPC + 5% polypropylene	2.97
8	M7	100% PPC + 5% Silica Fume	2.4
9	M8	100% PPC + 5% linseed oil	2.78



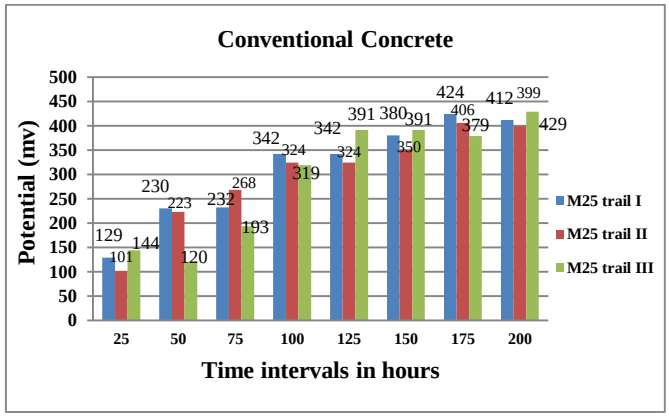
Graph 8: Flexural strength at 28 days in N/mm^2

7.CORROSION

Corrosion in aqueous solutions proceeds by an electrochemical process and anodic &cathodic electrochemical reactions must occur simultaneously. Over all charges up on the metal as a result of corrosion. Since the rate of the anodic and the cathodic reactions are equal. In this chapter, the experimental result of corrosion of RC Structures has been enumerated. The parameters like accelerated corrosion, half-cell potential readings were studied. The results of the investigation are presented in this paper.

Table 14: Half cell reading for conventional concrete

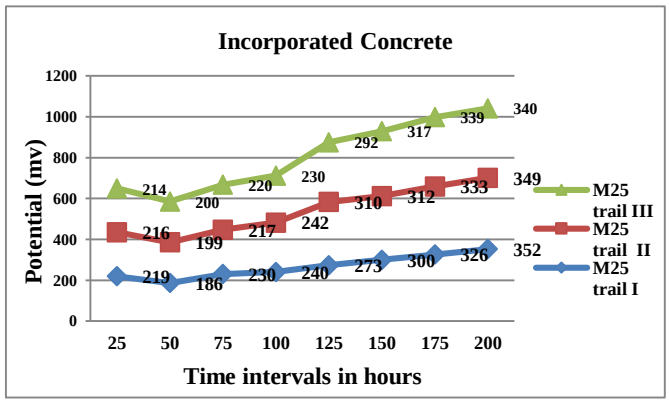
TIME INTERVALS	M25		
	TRAIL I	TRAIL II	TRAIL III
0	-	-	-
25	129	101	144
50	230	223	120
75	232	268	193
100	342	324	319
125	342	324	391
150	380	350	391
175	424	406	379
200	412	399	429



Graph 9: Shows The Half cell reading for conventional concrete

Table 15: Half cell reading for Incorporated concrete

TIME INTERVALS	M25		
	TRAIL I	TRAIL II	TRAIL III
0	-	-	-
25	219	216	214
50	186	199	200
75	230	217	220
100	240	242	230
125	273	310	292
150	300	312	317
175	326	333	339
200	352	349	340



Graph 10: The Half cell reading for incorporated concrete

9.CONCLUSION

Fiber and Mineral reinforced concrete has a great demand in construction industry.Fiber and Minerals are comes out to cheap and eco-friendly natural fiber, minerals also effective for low-cost housing construction and Durability of cement composites increases.Fiber and Minerals may be effectively utilized and since it is a non-corrosive, good flexural strength and it gets strength at 28days.From the result it is very clear that the compressive strength, flexural strength and tensile strength gets comparatively increases up to a certain limit.The cube compressive strength, split tensile strength and flexural strength increases for the optimum of 1.5%.Finally, we made an attempt for studying corrosion resistance of concrete using fiber and minerals. We conducted test for fresh concrete, hardened concrete and corrosion resistance.The test results shows, rate of corrosion decreases to the incorporate concrete when compared to conventional concrete.

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