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A Research on Polymer Modified Steel Fiber Reinforced Concrete Bagasse

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ABSTRACT

This research describes the results of using modified concrete made from steel fibers in Styrene Butadiene Rubber (SBR). The study reported the different characteristics and compressive strength of latex reinforced steel fibre modified concrete. Latex modified concrete is known as portland cement and combined with polymers dispersed in water when mixed. This is considered a resin dispersion. Polymers such as natural rubber concrete latex increase resistance to carbonation and penetration of chloride. Polymer can boost properties such as higher strength and lower water permeability than standard concrete when used as an admixture. Because of a low strength level of concrete, steel fibers have been applied to concrete to enhance its stress characteristics. The concrete specimens of polymers were cast and tested to enhance certain mechanical and physical properties, such as friction, tensile strengths, bending strengths and operation efficiency. For our work, we used Styrene Butadiene rubber latex polymer and hooked end steel fibers. At an interval of 0,5%, the percentage of steel fibers used was 0 percent, 0,5%, 1 percent. In percentage 5 percent, 10 percent, 15 percent, was taken from the steel fiber produced best and latex produced maximum power. 24 beam (500 mm X 100 mm X 100 mm) is made of a total of 24 cubes, (150 mm x 150 mm X 150 mm). Checking of hardened concrete characteristics at 28th days. Few SFRC applications in the irrigation systems. Polymer-modified steel reinforced concrete is very resistant to weathering, so it is commonly used in pavement lying.

KEYWORDS: *Betray, styrene butadiene rubber, steel fiber, bending power, friction, break tensile strength*

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INTRODUCTION

Concrete as a building material has great potential throughout the world, and only next to water consumption. Concrete is a composite material consisting of water, coarse granular material (fine and coarse aggregate or filler) embedded in a hard material matrix which fills the gap between the practical aggregate and collects it together. Concrete is commonly used in the manufacture of building buildings, frames, bricks, and walls. Concrete is used in large amounts almost everywhere that Mankind wants infrastructure. The worldwide use of concrete is twice that of steel, wood, plastic, and aluminum. Current world concrete consumption is estimated to be in the order of 14 billion tons per year. Large quantities of natural resources are required to meet this requirement, and day by day these natural resources are becoming depleted. Materials is the most commonly used type in construction materials with many attractive properties such as high compressive strength, rigidity, resilience under normal environmental conditions

The monomer is an organic molecular product that can chemically combine with molecules of the same or other product to form a high molecular weight substance known as polymer, which is known as polymerization as the mechanism by which they join. Adding latex to concrete increases the consistency of the material by which it manages crack ductility, resilience, impact and Fatigue, and resistance to carbonation. Reinforced concrete flooring is more effective than ordinary concrete cement flooring. "FRC is characterized as a composite material consisting of concrete reinforced with discrete random but uniformly spaced short length fibers." The fibers may be of steel, polymer or natural materials. FRC is regarded as a material with improved properties and not as reinforced cement concrete, while reinforcement is provided to reinforce concrete locally in tension zone. In hardened concrete the primary function of steel fibers is to change the cracking process. By changing the process of cracking the macro cracking becomes a micro cracking. The cracks are smaller in width thereby decreasing the concrete's permeability and enhancing the concrete’s overall cracking pressure. The fibers can bring a charge through the crack. In addition to minimizing permeability and increasing fatigue strength, a major benefit of using fiber reinforced concrete (FRC) is that fiber inclusion increases durability and load bearing capacity after the first crack in flexure behaviour. Developing countries are making every effort to achieve rapid development in the manufacturing and housing fields. Development requires comprehensive construction operations. Cement concrete; hitherto, given its many drawbacks, has been one of the essential building materials. For many superior properties over traditional cement concrete, the newly created "Polymer Concrete" is one of the most flexible building materials. In particular, polymer concrete is highly suitable for prefabricated building industry, irrigation systems, marine structures, nuclear power generation and desalination plants.

LITERATURE REVIEW

Dr. D. L VenkateshBabu,. To improve its tensioning properties, steel fibers were inserted into the concrete. The polymer concrete models were casted and tested with and without fibers to investigate the production of such mechanical and physical properties such as compressive forces, tensile strengths and workability. We used silicone Styrene Butadiene Rubber Latex and hooked end steel fibres in our work. They are latex 5 per cent SBR and steel fibers 0.5 per cent. The goods in reinforced concrete were tested in days 7 and 28. It was observed that the prescribed dose of fibers increased the early compressive strength of concrete but diminished the compressive force by 28 days. Steel fibers are used to increase the tensile strength of concrete Cement OPC Birla Super 53 style cement for our laboratory work. Both cement assets as per code IS 12269: 1987 is tested for 53 grade ordinary Portland cement. Generic density of cement is 3.15. The first and final settling time for cement was determined to be 70 minutes, and 220 minutes respectively. The fineness and consistency of cement is known to be 1.5% to 30%.

Z. A. Siddhiqi et.al. The effects of His study notes the results of applying polymer SBR latex to concrete both in terms of compressive strength and water absorption. SBR latex is also found to improve the internal structure of modified latex concrete resulting in a significant 28-day reduction of the water absorption volume. A contrast has been found of modified concrete from SBR in controlled concrete. From the findings it is inferred that on 28 days an increase in compressive strength and decrease in water absorption was found, while on the 7th day the early compressive intensity had negative effects, and early water absorption was low. Specimens range from 5% to 10%, with polymer dosages up to 20%.

V. M. Sautaraja et al present a analysis to examine the properties of concrete which can be further improved by incorporating SBR polymer along with steel fiber. This paper notes that improvement in strength due to the combined application of steel fiber and polymer SBR latex in standard concrete results in improved strength, resilience, hardness, cracking tolerance and propagation of cracks. The effect of curing condition on th intensity obtaining composite properties has also been observed. The P / C ratio preserving steady steel fiber differed with 0.75 per cent rise and 1.5 per cent bet wt raise. In cement: a massive increase in compressive strength and ductility following splitting is introduced into concrete. Test effects were found with respect to flexure and compressive forces, the increase in flexural and compressive strength was more efficient in dry curing, while the strength decreased with wet curing. Therefore it is expected to be inferred that the power of concrete is harmful to wet curing. Decreased workability is balanced in polymeric materials under dry curing environment due to the introduction of steel fibres.

R. Radhakrishnan clarified the application of polymer to repair existing concrete structures to repair existing concrete structures. For restore systems for increase service life, the amount of available approaches and resources, but the degree of effectiveness of any concrete repair relies largely on the appropriate choice and method of repair material use. Repair techniques are largely based on water penetration resistance and structural tensile cracking. To research the impact of cementitious content on SBR latex. A blend ratio of mortar1:3 was rendered with additional SBR by weight of cement at 20 per cent. In terms of compressive strength and break tensile strength for patched cylinder a comparative analysis was performed between added SBR specimen and control specimen without SBR. Along with the effect of thermal cycling on patched concrete, sorptivity experiments were also taken. It is understood from the study result that SBR modified cement mortar has very high water penetration and that SBR as a bonding agent has strong tensile strength relative to cement slurry. A SBR as a additive and as a cement mortar bonding agent meets the criteria provided by the ASTM specification. Upon thermal cycling, SBR multiplier retains improved efficiency and thus proved to be a

Sivakumar. M. V. N notes that various polymers have a comparative impact on concrete structural properties. A mechanical and flexural properties of transformed concrete made from polymer were found in this research. Two separate forms of latex-styrene butadiene polymers and acrylic styrene were used with various dosages (0-20 percent) to independently alter concrete composites in each situation. A statistical analysis of the results for the 7th as well as the 28th day was performed. Wet curing method was carried out up to the test date for a validity of this experiment. It was also found that polymer dosages are suitable for 15 per cent polymer in both situations. Although supporting the efficacy of each polymer, it was understood that due to its small particle size and comparatively less viscosity, acrylic styrene was proved superior to latex polymer.

R. Wang The dose of polymer ranged from 0-25 percent. The effects of wet and dry cure were generally detected at different healing ages. Findings were compared with guided polymer less mortar. The substantial improvement in flexural, split tensile and compressive strength with the air-curing study was observed at a later age compared to water-curing specimens with. Top polymers price was 20 per cent. The greater early intensity and adhesion to old building materials allows rebuilding of the buildings simpler in the shortest practicable period. In concrete buildings the loose concrete is removed, and the resulting voids are filled with materials with strong early resistance. The polymer r modified mortar and concrete may be used for various methods of repair, rehabilitation and stabilization of concrete and masonry buildings depending on the shape and degree of harm caused by the earthquake. Using polymer in cement mortar renders the mortar workable, and improves Sturdy's water cement ratio. At later ages, air cure is preferred to raise the severity of the higher dose.

Abdulkader Ismail A. AL. Hadithi et.al. In this study, the fiber percentage varies by weight of cement up to 1.5% as well as the acrylic polymer content varies as 3%, 7% and 10% by weight of cement. Significant curing of specimens borne by Folic process as minimum water sunk in curing. Test found showed an increase in all control structural properties with the inclusion of steel fibers. Although the introduction of acrylic polymers along with steel fiber has a greater effect than reinforced concrete constructed from steel fiber. There was an improvement in the compressive strength of reinforced concrete made from steel fiber (14.2 percent -29.2 percent), although an improvement in PMSFRC was observed (44.8-86.64 percent). Splitting tensile strength was found to increase up to (50-91 percent) for concrete steel fibers, which in the case of PMSFRC tends to increase up to (102.4-124.7 percent). Related increments of flexural intensity were observed as (24.2-48.3 percent) for SFRC and (62-78 percent) for PMSFRC.7 percent of P / C with 1 percent difference of volume fraction was considered to be maximum.

Y. M. Ghugal. Established an experimental study of polymer-modified cement mortars. The factors regarded were the healing age of the substance in polymer and the curing process. This researched the effect of polymer admixture on compressive, tensile breakage, flexural resistance and workability. The dose of polymer ranged from 0-25 percent. The effects of wet and dry cure were generally detected at different healing ages. Findings were compared with guided polymer less mortar. The substantial improvement in flexural, split tensile and compressive strength with the air-curing study was observed at a later age compared to water-curing specimens with. Top polymers price was 20 per cent. The greater early intensity and adhesion to old building materials allows rebuilding of the buildings simpler in the shortest practicable period. In concrete buildings the loose concrete is removed, and the resulting voids are filled with materials with strong early resistance. The polymer r modified mortar and concrete may be used for various methods of repair, rehabilitation and stabilization of concrete and masonry buildings depending on the shape and degree of harm caused by the earthquake. Using polymer in cement mortar renders the mortar workable, and improves Sturdy's water cement ratio. At later ages, air cure is preferred to raise the severity of the higher dose. Thanks to significant changes in technical properties and durability, technologies have been effectively used to rehabilitate the damaged, demolished and subtracted concrete and masonry buildings to be restored and rebuilt in the shortest possible time.

Materials and Methodology

The materials used for the preparation of concrete

- Cement
- Fine aggregate
- Coarse aggregate
- Steel fiber
- Styrene-butadiene rubber (SBR)
- Super plasticizer
- silica fume
- Water

To investigate the properties and suitability 0f the fine aggregate for the intended application, the following tests were carried out.

- Workability
- Slump Test
- VeBe Test
- Compressive strength.
- Density of concrete.
- Flexural Strength

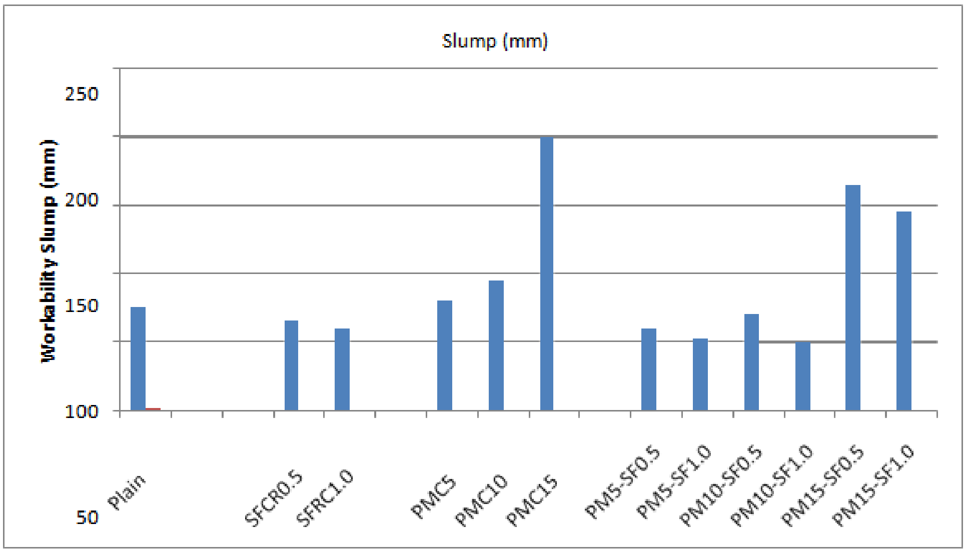
RESULT AND ANALYSIS

Workability

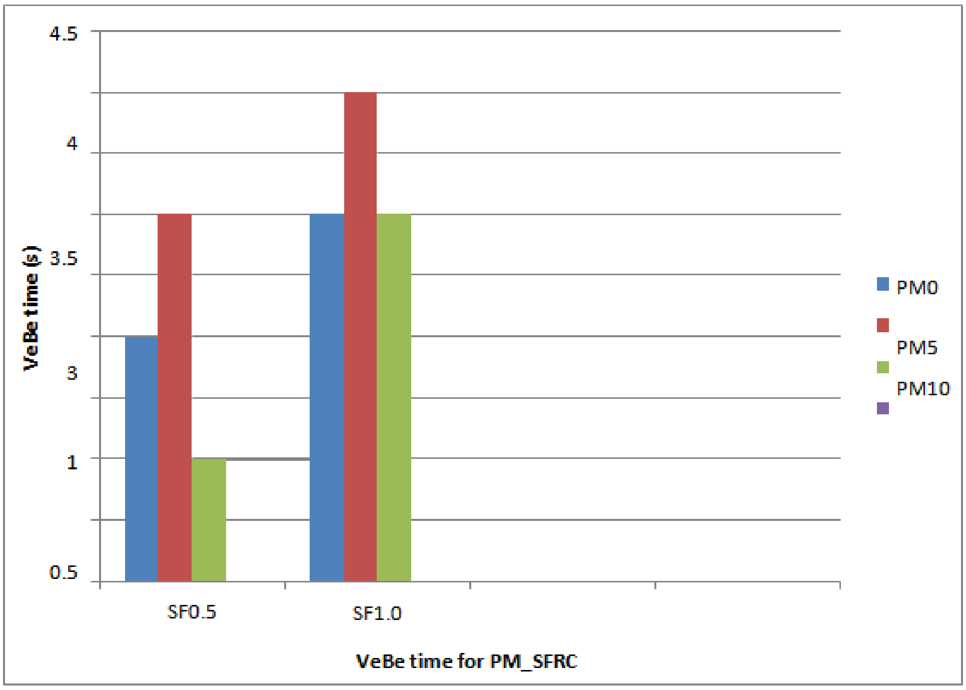
Good workability is important for high strength concrete because less effective compaction can result in loss of strength. Other factors, such as total water content, water / cement ratio, additional cement materials and aggregate shape and size, have an effect. workability. The basic parameter such as cement content, silica fume content, and water content set for plain concrete for ease of achievement of strength objectives. Just varied following parameter.

Result of workability tests

Category	Description	Steel fiber	Polymer	Workability	
				Slump (mm)	VeBe time (s)
Control M 1	Plain	--	---	75	---
Steel Fiber Reinforced Concrete					
M 2	Steel Fiber Reinforced Concrete 0.5	0.5%	---	68	3
M 3	Steel Fiber Reinforced Concrete 1.5	1.5%	--	62	4
Polymer Modified Concrete					
M 4	Polymer Modified Concrete 5	--	5%	80	--
M 5	Polymer Modified Concrete 15	---	15%	200	--
M 6	Polymer Modified Concrete 20	---	20%	260	----
Polymer Modified -FRC					
M 7	Polymer Modified 5- Steel Fiber 0.5	0.5%	5%	63	3
M 8	Polymer Modified 5- Steel Fiber 1.0	1.0%	5%	54	5
M 9	Polymer Modified 10- Steel Fiber 0.5	0.5%	10%	72	2
M 10	Polymer Modified 10- Steel Fiber 1.0	1.0%	10%	53	4
M 15	Polymer Modified 15- Steel Fiber 0.5	0.5%	15%	167	0
M 16	Polymer Modified 15- Steel Fiber 1.0	1.0%	15%	148	0



Slump results of PM-SFRC mixes



VeBe Time for PM-SFRC mixes

Compressive strength

Compressive strength test were carried out according to UTM. At least three cylinder and cube specimen of each group were tested. All of the tests were carried on compression testing machine at constant loading rate of 5250 N/s as per IS: 516-1959.

Universal testing machine

Table: Time dependence of compressive strength of PMC

Polymer content (%)	7 d	14d	21d	28d
5	72.21	---	---	45.88
5	---	54.25	---	96.63
5	----	----	86.25	84.36
10	63.54	-	----	71.25
10	----	73.25	---	79.99
10	---	---	77.78	80.64
15	----	---	73.54	71.75
15	----	-----	77.81	67.82
15	---	75.21	----	75.42

CONCLUSIONS

Various conclusions are drawn in this chapter on the basis of results and analysis done in the previous chapter. Scope for future study has been included in this chapter. The aims of this research were to study mechanical properties of three type of concrete namely plain concrete(PC), steel fiber reinforced concrete (SFRC)and latex modified steel fiber reinforced concrete (PM-FRC)has been determined on the basis of various test namely compressive test, flexural test, and workability tests results carried out in laboratory. To study a high performance concrete system incorporating both fibers and polymer(PM_FRC) in term of toughness and durability also. Based on experimental investigation following conclusions may be drawn:

PMC optimization

- Polymer latex greatly increases workability (slump time and VeBe time). The addition of 15% latex will produce high resistance PMC with a water / cement ratio 0.28 Has the features of self compacting.
- The water – is affected by the recession, reducing the potential of the polymer; it is more effective at higher slumps than at lower slumps. This should be remembered when using both a superlasticizer and a polymer to achieve specific workability for mix designs or mix optimization.
- Compressive strength reduction is is more prone to increased latex dosage for high-strength PMC than standard PMC. A suitable healing technique is important for achieving high strength concrete with latex. This provides the required balance between suitable conditions for film forming and concrete hydration with a low water / cement ratio.
- The flexural strength continued to decline as the polymer / cement ratio increased. Under both compressive and flexural loading the PMCs still failed in a brittle fashion, although a small improvement in ductility was observed.

SFRC optimization

- Steel fiber decreases operability (slump time and VeBe time). Adding 1.25 percent steel fiber to the fixed water / cement ratio indicates lowest workability 0.28. See below. Both superlasticizer and concrete air entrainment criteria.
- Its compressive strength is improved as the fiber content in concrete is decreased, showing maximum strength at 1 % of the total cement fiber content. Appropriate high water / cement ratio is used to achieve the required balance between state.
- SFRC's flexural strength seemed to increase to 1% of steel fiber and then continue to decrease. Its fiber / cement ratio is checked for variance.

PM-SFRC optimization

With-polymer dose, the workability of PM – SFRC decreases to differing degrees. To achieve a workable low w / c ratio combination, polymer / cement ratio of less than 15 percent needed additional superplasticizer. Steel fiber is more powerful than polymer fibers in terms of flexural strength and hardness without polymer in FRC. The flexural durability of the mixes was evaluated using three methods. PM10- SF1.0 was found to be the strongest blend, exhibiting strong strength and strain hardening characteristics; this combination will be good for PM-SFRC structural use. The key explanation for the superior output is the fact that the polymer-cement co-matrix improves the cement's total binding ability. Polymer latex demonstrated varying effects on flexural actions based on the fiber material. Generally speaking, steel fiber is more likely to be strengthened by incorporating polymer than SFC. The ideal dose for SFRC was 10 per cent and for PMC was 5 per cent. Steel fiber proved to be more polymer-fibre compliant than steel fiber alone. Steel fiber plays a major position in PM-SFRCs, and thus the fibers' contribution to hardness is far greater than polymer's contribution. The improvement in hardness attributed to decreased number of fibers in the PMC matrix is distinct from that of the HSC matrix. In PMC matrix, steel fibre is more effective than in HSC simple matrix. SFRC's compressive strength analyzes for differing polymer material. The steel fiber density at which the combination indicates the optimum strength needed for further analysis. PM10-SFRC1.0 displays the overall intensity of both tests.

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