STUDY EFFECTS OF VARIOUS DOSAGE OF POLYPROPYLENE FIBER AND DIFFERENT DOSAGE OF STYRENE BUTADIENE RUBBER ON COMPRESSIVE STRENGTH OF POLYMER MODIFIED MORTAR

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Abstract

The perception of use polymer modified mortar is well known in repair engineering, which includes various % of styrene butadiene rubber, acrylic and other materials. The worry should not be solely with repair materials but with the uses to which they are being to put and lack of awarenessof material during application, Material (say mortar) and end product(composite repair)will not perform and then less durable. In this paper, effects of 10%, 15%and 20% of SBR in polymer modified mortar as well as polypropylene fibre in the range of 0% to 1% on compressive strength has been studied.

Key words: *Individual compressive strength, polypropylene fibre,SBRpolymer modified mortar.*

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1. INTRODUCTION

Various studies prove and alarming about deterioration and distress plenty of existing concrete structures worldwide in third millennium. [15][17]

Simultaneously, it must also be documented that many repaired concrete structures are severely deteriorated only after a few years having been repaired. Each country is facing this major problem: How to repair, rehabilitate and protect the existing stock of concrete structures in order to prolong their service life. All over the world, concrete has been well and truly used all the way throughout the centuries. In recent years the image of concrete has been shaken by durability problems, by often poor performance, and most of all, by concrete repair failures. The repair failures and endless “repair of repairs” made a considerable contribution to the current perceptions of concrete. The poor durability performance of many concrete structures is causing disruption and expenditure on remedial works which owners and society cannot afford and do not wish to see repeated. [16][13]

Various polymers like SBRtrim down the rate of water evaporation, allow the crystal structure to keep growing and building strength during these important early curing stages. This reduced water evaporation is especially important in thin applications, where the surface area for evaporation is high, relative to the volume of the mortar. It is necessary and preferable to add polypropylene fibre to resist the adverse effects of volume changes in polymer modified mortar. [8][9][34]

2. REASEARCH SIGNIFICANCE

Cracking of the repair material is cause of repair failure and lead to most serious deterioration in concrete and other cement-based materials,. When large, visible cracks become interconnected with already exist micro-cracks of aggregate mortar and reinforcement mortar, the network of cracks facilitates the transport of aggressive ions and gases to the embed reinforcement, leading to untimely corrosion and deterioration. The structure of cement-based materials is complex. It is a heterogeneous mixture of different components with widely changeable characteristics and properties. It is a physico-chemical component consisting of hydratedcementitious materials, aggregates, additives and admixtures. With composite systems, such as repair, the complex link between phenomena, theory and expressive parameters encourages a more detailed study of the materials based on the properties of the component phases and how these interact. Indisputable progress has been made in the field of repair materials. But the material that has the required properties for a particular application is only one stage in the multipart system that makes up the totality of concrete repair. The problem of durable concrete repair is not simple than it appears at first sight due to notmatch with substrate. So, if material does not perform, we cannot say “high-performance material”. In additionto that before we continue to talk about the subject of repair materials astutely, we have to reorganizeour thoughts and ideas. [7][49][51]

The data presented in this paper is part of our research work; wepresented effects of 0% to 1% of Polypropylene fibre and 10%, 15% and 20% of SBR in PMM’s compressive strength.

3. THE METHODOLOGY AND INVESTIGATIONS

3.1 Experimental Programme

We studied effect of various dosages of polypropylene fibre and SBR on compressive strength of polymer modified mortar specimens.

3.1.1Constituent Materials

Properties of Cement

Sr. No.	Test	Results
1.	Fineness (By Blaine's Method)	3369cm2/gm
2.	Setting Time Initial Final	 90 Minutes 230 Minutes
3.	Compressive Strength (kg/cm2) 3 days 7 days 28 days	 172 320 535
4.	Soundness (Le Chatterley's Method) Expansion between two joints	1.2 mm
5.	Normal Consistency	29.5%

Properties of fine Aggregate

Properties	Fine Aggregate
Fineness Modulus	3.11
Specific Gravity	2.78
Bulk Density (kg/m3)	1886.0

Sieve Analyses of Aggregates

IS: Sieve designation	Fine Aggregate (Sand)	
	Cum % of retained	Cum % of Passing
40 mm	-	-
25 mm	-	-
20 mm	-	-
10 mm	-	-
4.75 mm	5.0	95.0
2.36 mm	16.0	84.0
1.18 mm	40.2	59.8
600 Micron	58.2	41.8
300 Micron	92.2	7.80
150 Micron	99.2	0.80

Water: The drinkable water was used during experimental program

Polypropylene fibre:

- 6 mm polypropylene fibres used for experimental work.
- Fine fibrillated harbourite fibre conform ASTMC-1116 & ASTMC1028

1. SBR (styrene butadiene rubber)

It is a polymer based on styrene butadiene rubber, we can use it for structural rehabilitations, waterproofing treatment, floor screeds, & topping and concrete repairs.

Advantages of SBR are excellent adhesive to reinforcement & concrete, increased flexural strength, increased tensile strength; we get compressive strength comparable to that of concrete, reduced shrinkage, reduced water permeability, improved chemical resistance.

Typical properties of SBR & modified mortar and typical values are Ph: 9.5 Specific gravity: 1.01 Freeze thaw stability: With stands at least 5 freeze thaw cycles, but storage in covered areas, Stabilization: Non-Ionic, Anti Oxidant, Bactericide, Antifoam, Yield is 0.1 m above mix 10 m area at 10mm thickness.

Technical data

1) Color: Bluish white/milky liquid polymer.
2) Solid Content: 36% (ASTM D 1417-10)
3) Specific Gravity: 1.02
4) Bond Strength: 2 times more than normal cement slurry coating.

Mix Proportions and Experimental Factors:

We casted and tested following mixes for our experimental study:

Table1: Various mixes

Description of Specimen For Mortar (1:2)	%SBR	%Dosage of Fibre	Nos.of specimens
CUBE (70.6mmx70.6mmx70.6mm)	10	0	Each mix have cast 6nos.of specimens = 90 Nos.
	15	0	
	20	0	
	10	0.25	
	15	0.25	
	20	0.25	
	10	0.5	
	15	0.5	
	20	0.5	
	10	0.75	
	15	0.75	
	20	0.75	
	10	1.0	
	15	1.0	
	20	1.0	

15 different mixes were prepared with cement sand mortar (1:2) using SBR at varying percentage of 10, 15, and 20by weight of cement and polypropylene fibre % of 0.0, 0.25, 0.50, 0.75, and 1.00 also by weight of cement and as per Table 1.

Fig.1 Photographs of Testing and mixing Polymer Modified Mortar

Test Results: Test results are presented graphically and in tabular form.

Table.2 Variation in compressive strength with various % of fibre in PMM (SBR 10%)

PMM SBR 10%					
% fibre	0	0.25	0.5	0.75	1
(7 - DAYS) Avg. Comp. Strength (MPa)	24.44	25.27	24.07	23.69	23.47
(28 - DAYS)Avg. Comp. Strength (MPa)	30.64	31.67	30.17	29.70	29.42

Table.3 Variation in compressive strength with various % of fibre in PMM (SBR 15%)

PMM SBR 15%					
% fibre	0	0.25	0.5	0.75	1
(7 - DAYS) Avg. Comp. Strength (MPa)	29.03	29.7	30.24	28.47	28.2
(28 - DAYS)Avg. Comp. Strength (MPa)	33.84	34.62	35.25	33.19	32.87

Table.4 Variation in compressive strength with various % of fibre in PMM (SBR 20%)

PMM SBR 20%					
% fibre	0	0.25	0.5	0.75	1
(7 - DAYS) Avg. Comp. Strength (MPa)	32.33	33.07	33.47	31.63	31.33
(28 - DAYS)Avg. Comp. Strength (MPa)	36.45	37.28	37.73	35.66	35.33

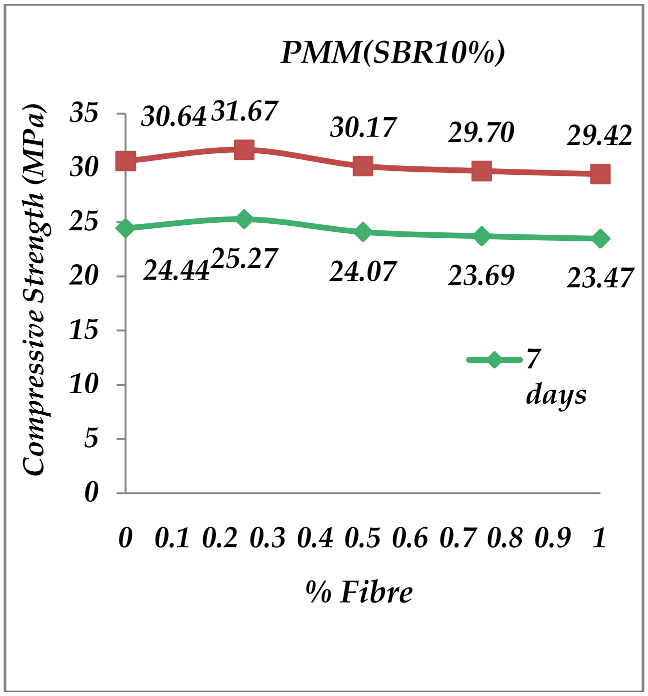

Fig.1 Variation in compressive strength with various % of fibre in PMM (SBR 10%)

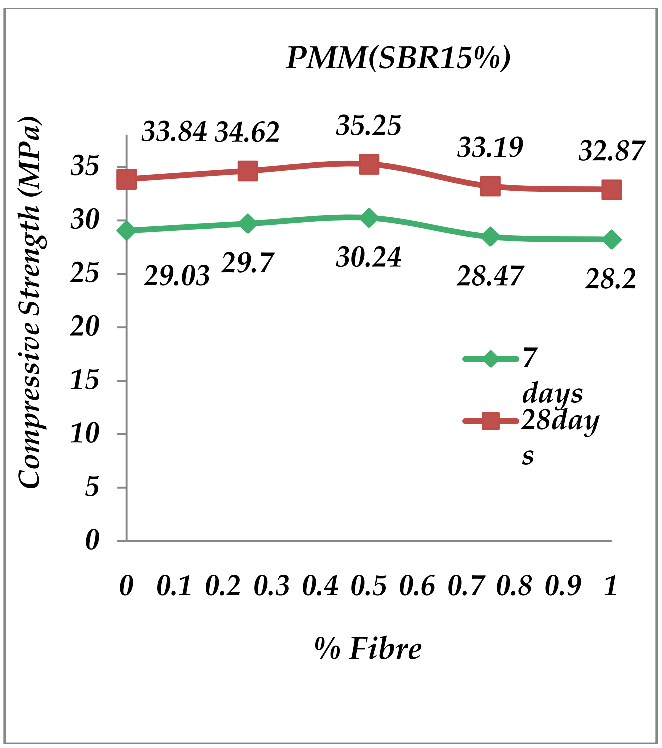

Fig.2 Variation in compressive strength with various % of fibre in PMM (SBR 15%)

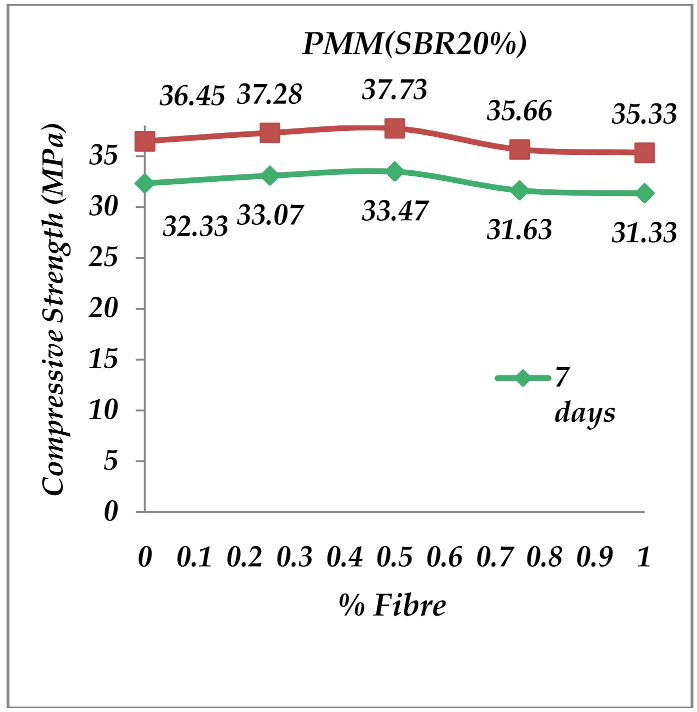

Fig.3 Variation in compressive strength with various % of fibre in PMM (SBR 20%)

4. DISCUSSION ON TEST RESULTS:

1. It is found that Compressive strength about 3% to 4 % increased at 0.25% polypropylene fibre by weight of cement, therefore dosage of optimum PPF suggested is 0.25% for PMM(SBR 10%).
2. It is also noted, for PMM (SBR 15% and 20%)Compressive strength about 4 % increased at 0.50% polypropylene fibre by weight of cement, therefore dosage of optimum PPF suggested is 0.50 % for PMM(SBR 15% and 20%).
3. Compressive strength also increased 10%-11% increased with change dosage of SBR 10% to SBR 15% by weight of cement in PMM.
4. We also found Increments noted in compressive strength by 15%-16% with change dosage of SBR 10% to SBR 20% by weight of cement in PMM.

CONCLUSIONS

- Dosages of Polypropylene Fibre (PPF) recommend, for PMM SBR 10% (0.25% PPF), SBR 15% and SBR 20% (0.50% PPF)to get optimum compressivestrength.
- It is also concluded by increasing of dosage of SBR in PMM compressive strength increased 10-12% by dosage SBR 10% to SBR 15%, but only 5-7% increment observed when switch to dosage of SBR 15% to SBR 20%.

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