APPLICATION OF POLYPROPYLENE NON WOVENS WITH FISH SCALE IN REINFORCED CONCRETE

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ABSTRACT. In the construction field, concrete plays a vital role in the world. Simultaneously, lot of research works are in progress to improve the strength of the concrete in various aspects. The involvement of textile materials in the concrete starts with fibre reinforced concrete. Apart from textile materials fly ash and silica fume are also used in the concrete reinforcement to improve strength and to prevent crack formation. The use of fibres in random reinforcement results in crack resistance and compressive strength improvement. The idea to improve tensile strength of the fabric using high performance fibre nonwoven material is the base of this experiment. The polypropylene is used in the fabric as a matrix composed by multiple layers of nonwovens stick together by resin bonding. To enhance the performance of the concrete, the fish scale is also involved in this experiment. The impact of polypropylene nonwoven fabrics and fish scale in the strength performance of the concrete is studied in a comparative manner with the control concrete.

Keywords: Fish scale, Polypropylene, Concrete, Compressive strength.

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INTRODUCTION

In the present scenario, the fastest growing field is the construction industry. This is due to the high demand for the infrastructure for all the peoples from residence to industry. The base of the construction is the concrete which is a composite material of water, coarse aggregate, fine aggregate and cement. Concrete is strong in compression and weak in tension. The cracks are formed in the concrete due to the compressive stress and tensile stress. The concrete adds steel reinforcing bars which has the advantage of rust formation in the steel bars due to the moisture in the concrete which fails after a long time.

These problems require intensive research work which initiates the fibre reinforced concrete which improves the crack resistance of the concrete. Different types of fibres were used in the reinforcement and the performance of the concrete was studied and proved that the performance is better than the ordinary concrete. The fibre reinforced concrete is commercially applied to all the construction works. This achievement with the fibre reinforced concrete stimulates further research work to improve the tensile strength of the concrete and to replace the steel bars which are sensitive to chloride ions. The replacement of steel bars with suitable textile structure will improve the life of the concrete and also economically viable than the steel reinforced concrete. The research work is broadened to find the suitable textile structure and suitable textile material to replace the steel bars. In this row, nonwoven fabrics and fish scale usage is a new idea to improve the concrete performance.

LITERATURE REVIEW

The fibre reinforced concrete produced with different types of fibres has a huge data base for the performance properties. This experiment work should quote the polypropylene fibre properties and PP fibre reinforced concrete performance to validate this work. Also it is required to review the properties of fish scale and application of fish scale in various fields.

In a research work, Krishna rao et.al, studied the behaviour of polypropylene fibre reinforced fly ash concrete beams in flexure and shear strength. In this work, polypropylene fibre and fly ash is incorporated in various proportions in the concrete and the performance of the concrete is studied. It has been proved that there is a significant increase in flexural and shear strength of the concrete in all the proportions of the fibre and fly ash.

Ramandeep et.al, studied the effect of flyash content with steel and polypropylene fibres on the properties of flyash concrete. The incorporation of flyash and polypropylene fibres increase the compressive strength, split tensile strength and flexural strength of the concrete.

Pena et.al, studied the mechanical properties of polypropylene mesh and polypropylene fibres reinforced light weight concrete composites. The study shows that load carrying capacity of PP mesh composites in increased with 1% higher chopped PP fibres.

Lin et.al, studied the mechanical properties and laminate structure of Arapaima gigas fish scales. The fish scales exhibit very high young’s modulus and strength properties.

MATERIALS AND METHODS

In this work, polypropylene fibre nonwoven fabric is the primary reinforcement material in the concrete. The polypropylene fibre is sourced and then converted as nonwoven fabric. The secondary reinforcement material chosen is the fish scale. The fish scale is collected from fish market. Then it is washed thoroughly and soaked in distilled water 24 hrs. 25gram NaCl solvent with 1 litre distilled water. The purpose of NaCl is to remove the non-collagen proteins and remove the odour. This process is carried out in room temperature with Ph 5-6.

Fish scale is a nano composite consisting of type I collogen and calcium deficient apatite containing carbonate ions. The tensile strength of the fish scales is on an average value of 93Mpa. The polypropylene nonwoven fabrics are attached together by PVC resin to form a matrix. The concrete is prepared using cement, fine aggregate (sand), coarse aggregate and water with a mix ratio of 1:1.5:3 (cement: sand: coarse aggregate).

The concrete cubes are prepared with the help of the moulds. Three types of cubes are prepared in the experiment namely plain concrete, polypropylene nonwoven matt reinforced concrete and fish scale stuffed polypropylene nonwoven matt reinforced concrete. The size of the cube is 150mm x 150mm x 150mm. the compressive strength of the cubes are tested for 7 days and 14 days to assess the concrete performance.

RESULTS AND DISCUSSION

The cubes were tested for the compressive strength and the results are represented in compressive stress in N/mm^2.

Table 1 compressive strength results of

S.No.	Type of concrete	7 days compressive stress in N/mm^2	14 days compressive stress in N/mm^2
1.	Plain concrete M_{20} grade	10.5	15.2
2.	Polypropylene nonwoven matt reinforced concrete	13.4	20
3.	Fish scale stuffed polypropylene nonwoven matt reinforced concrete	16	24

The percentage increase in the strength of the fibre matt concretes compared to the plain concrete also calculated and reported as below.

Table 2 Percentage increase in strength analysis

S.No.	Type of concrete	% increase in strength than plain concrete in 7 days	% increase in strength than plain concrete in 14 days
1.	Polypropylene nonwoven matt reinforced concrete	2.2%	1.1%
2.	Fish scale stuffed polypropylene nonwoven matt reinforced concrete	5.8%	4.4 %

The graphical representation of the compressive stress of the concretes and the percentage increase of the strength of the concretes also shown in the graphs below.

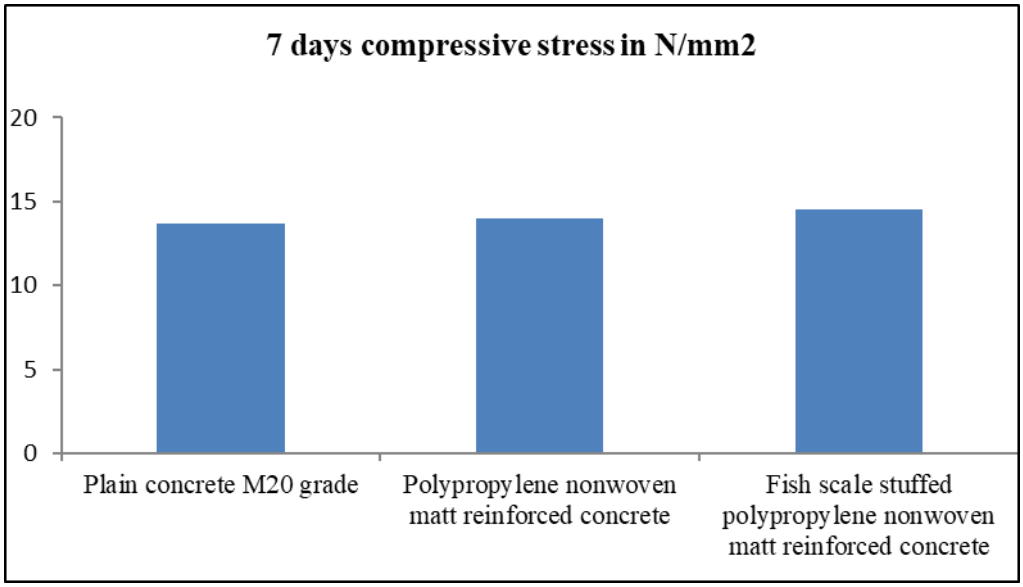

Figure 1 7 Days Compressive stress in N/mm2

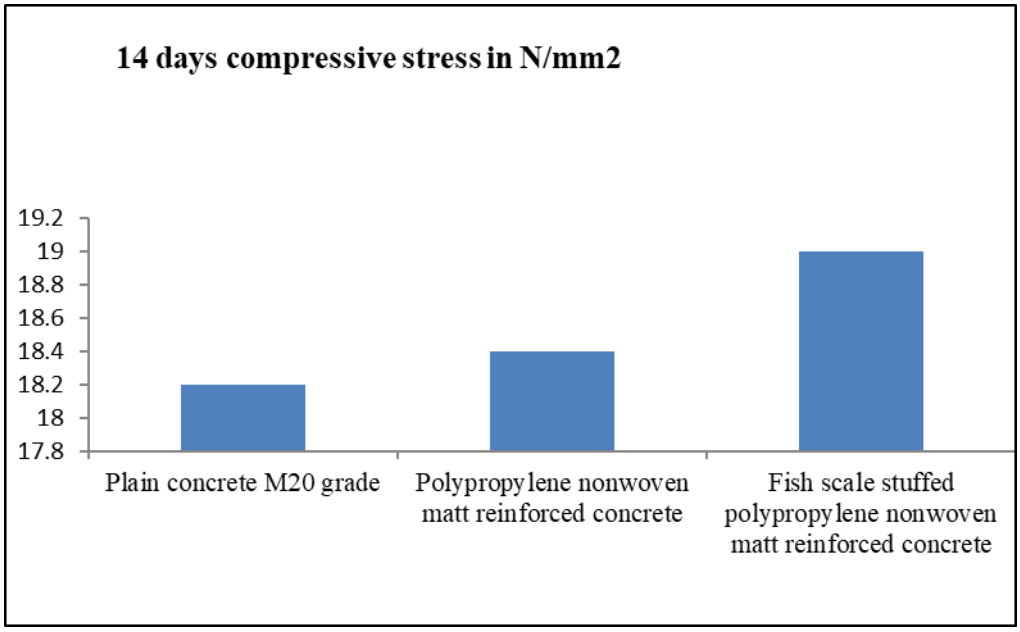

Figure 2 14 Days Compressive Stress in N/mm^2

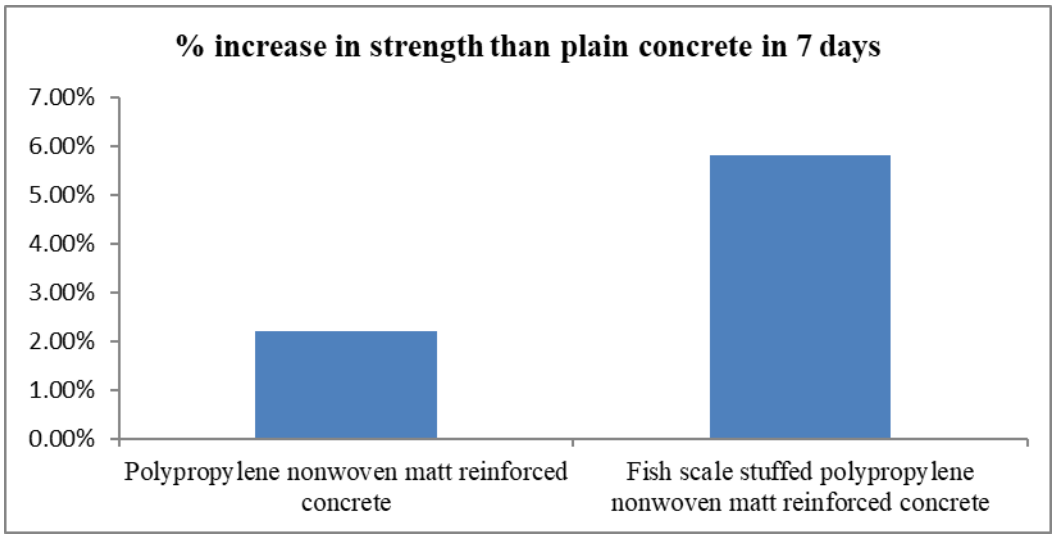

Figure 3 Percentage increase in strength than plain concrete in 7 days

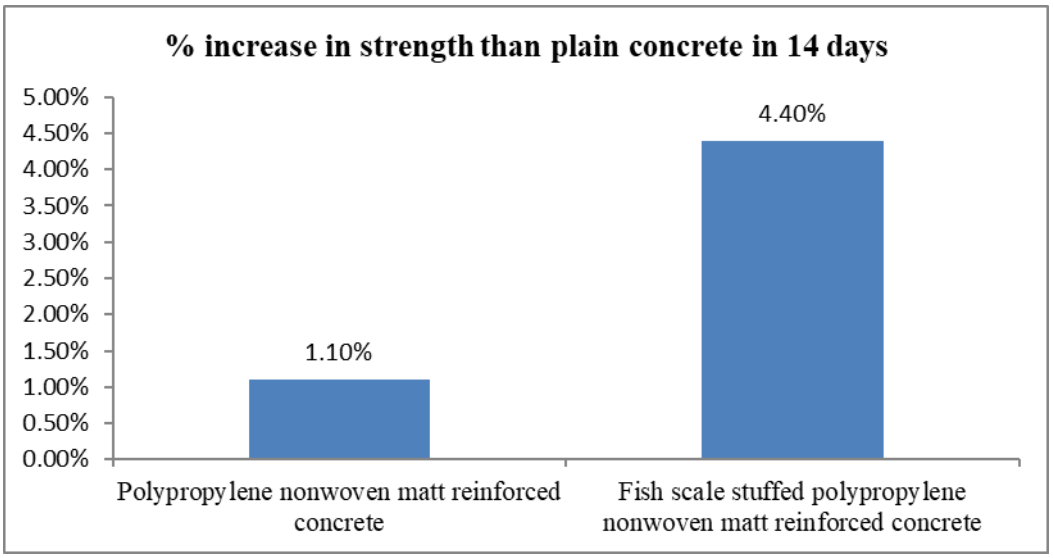

Figure 4 Percentage increase in strength than plain concrete in 14 days

The above result shows that the fish scale stuffed polypropylene nonwoven matt reinforced concrete has a very good compressive strength than the other concretes. The polypropylene nonwoven matt reinforced concrete also has higher compressive strength than plain concrete but lower than the fish scale stuffed polypropylene nonwoven matt reinforced concrete. The percentage increase in the polypropylene nonwoven matt reinforced concrete is 2.2% at 7 days and 1.1% at 14 days. The percentage increase in the fish scale stuffed polypropylene nonwoven matt reinforced concrete is 5.8% at 7 days and 4.4% at 14 days.

CONCLUSION

The experiment results conclude that incorporation of polypropylene nonwoven matt increases the compressive strength of the plain concrete. Also the addition of fish scale into the polypropylene nonwoven matt increases the compressive strength a little bit higher than the previous one. Hence the conclusion is made that polypropylene and fish scale addition in the plain concrete improves the concrete performance in terms of compressive strength and these materials can be studied in the concrete beams for tensile strength improvement.

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