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EVALUATION OF PROPERTIES OF CONCRETE USING RICE HUSK ASH AND POLYPROPYLENE FIBRE

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Abstract – In today's world, the construction activities are increasing gradually. And in construction industry concrete has a very important role. So the studies should be done in order to improve properties of concrete. The various industrial waste like fly ash, rice husk ash, silica fume etc. possess approximately similar properties of cement. So it is very reasonable to replace the cement partially with these waste materials to make the concrete cost effective and more durable. Also various fibres like polypropylene fibre, steel fibre, glass fibre etc. should be used to increase the concrete properties. In this study, the effect of replacing the cement with RHA and addition of polypropylene fibre has been studied. The percentage of RHA is 10% by weight of cement and that of polypropylene is 0.2%, 0.4%, 0.6%, 0.8%, 1.0% by weight of cement. M35 grade of concrete is used in this study.

Keywords - rice husk ash, polypropylene fibre, compressive strength, split tensile strength, flexural strength.

I. INTRODUCTION

Construction of houses, bridges and roads etc. are the some of the construction activities in which concrete is used. The basic constituents of concrete are cement, coarse aggregate, fine aggregate and water. Concrete is the one of the all around utilized material in the world. As the concrete is strong in compression but frail in tension. The tensile strength of concrete is about 10% of the compressive strength. Cement industries are one of the main sources of emission of carbon dioxide gas which is the major source of the greenhouse gas. That is why we need to replace the cement with some green materials which reduce the emission of greenhouse gas and also increase the properties of the concrete. As we know India is leading rice producing country. So due to this huge amount of rice husk ash is produced every year, which creates its disposing problems. The possible solution could be to replace the cement with rice husk ash because rice husk ash contains about 85% to 95% amorphous silica. And also it is highly reactive and makes the concrete cheaper. Fibres are used in concrete to increase its tensile strength as well as durability. Polypropylene fibre is the common type of fibres which are used in concrete. They also prevent the formation and propagation of micro cracks.

II. MATERIALS

OPC cement of grade 43 is used in this study. Fine aggregates used are river sand of zone III which have specific gravity of 2.66 and absorption of water is 1.2%. Crushed aggregate are used as coarse aggregate which are angular in shape and have specific gravity of 2.68 and absorption of water is 0.99%. Potable water is used in this experiment.

III. RESEARCH OBJECTIVES

The objectives of the research are as per the following:

- To design concrete mix of M35 grade.
- To design concrete mix with addition of RHA and polypropylene fibres at different dosages and combinations.
- To determine the workability of fresh concrete impregnated with a combination of RHA and polypropylene and compare with the reference mix.
- To evaluate compressive, flexural and tensile strength of concrete and compare with the reference mix.

IV. METHODOLOGY

- Preparation of design mix of M35 grade using relevant IS code.

- Ordinary Portland cement (OPC) should be use as binder.
- Preparation of different concrete mix by keeping the percentage of RHA fix as 10% and varying the percentage of polypropylene fibres.
- Varying percentages of polypropylene fibres are 0.2%, 0.4%, 0.6%, 0.8%, and 1%.
- Comparative study of compressive, flexural, split tensile strength of concrete mix thus prepared.

V. RESULTS AND DISCUSSION

In this study, test of compressive strength, split tensile strength and flexural strength are conducted. Different aftereffects of tests are given in following tables where FMC stands for fibre modified concrete:

TABLE 1: Compressive strength results

Mix Group	% of RHA	% of polypropylene fibre	Strength (N/mm^2)	
			7 days	28 days
RM	0.0	0.0	33.3	44.8
FMC 0.2	10	0.2	32.8	42.4
FMC 0.4	10	0.4	33.5	43.9
FMC 0.6	10	0.6	35.9	45.1
FMC 0.8	10	0.8	35.3	44.7
FMC 1.0	10	1.0	34.8	44.3

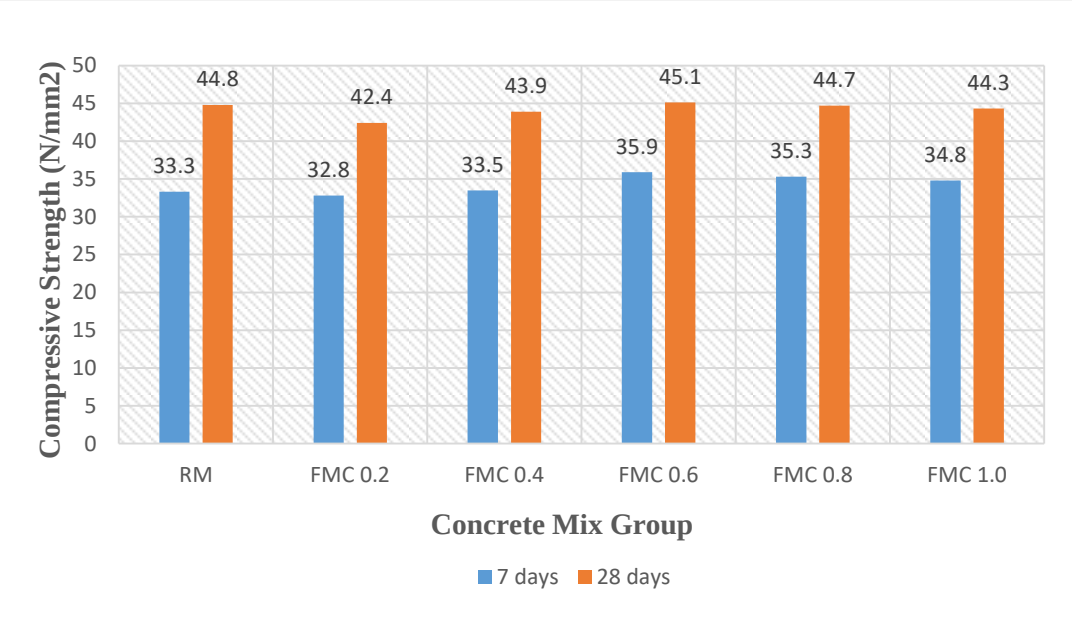


TABLE 2: Split tensile strength results

Mix Group	% of RHA	% of polypropylene fibre	Strength (N/mm^2)	
			7 days	28 days
RM	00	0.0	3.39	4.18
FMC 0.2	10	0.2	3.34	4.54
FMC 0.4	10	0.4	3.58	4.72
FMC 0.6	10	0.6	3.74	4.74
FMC 0.8	10	0.8	3.72	4.88
FMC 1.0	10	1.0	3.77	5.02

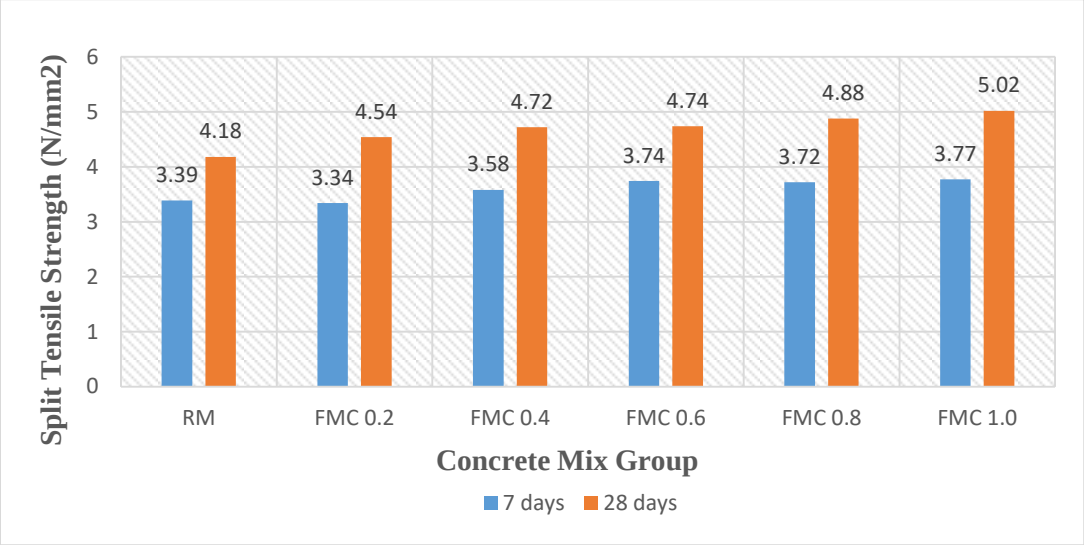
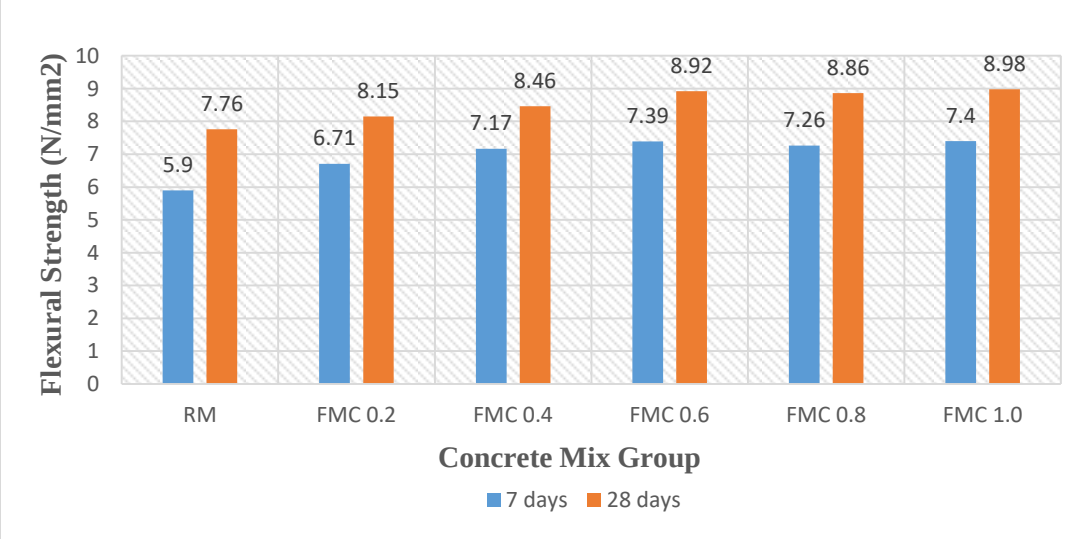


TABLE 3: Flexural strength results

Mix Group	% of RHA	% of polypropylene fibre	Strength (N/mm^2)	
			7 days	28 days
RM	00	0.0	5.90	7.76
FMC 0.2	10	0.2	6.71	8.15
FMC 0.4	10	0.4	7.17	8.46
FMC 0.6	10	0.6	7.39	8.92
FMC 0.8	10	0.8	7.26	8.86
FMC 1.0	10	1.0	7.40	8.98



VI. CONCLUSIONS

- As percentage of polypropylene fibre increases the workability decreases.
- Compressive strength has no significant effect as the percentage of polypropylene fibre is increases. Optimum mix is obtained at 0.6% of polypropylene fibre.
- With increase in percentage of polypropylene fibre, split tensile strength also increases.
- With increase in percentage of polypropylene fibre, flexural strength increases appreciably.

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