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Study the Behavior of Concrete by Partial Replacement of Coarse Aggregate with Plastic Granules

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ABSTRACT
Now a days Solid waste management is a major environmental concern in our country. The objective of this study is to use the plastic granules in concrete as a replacement of coarse aggregate. The aim of the present study is to investigate the properties of concrete using plastic granules. With these mechanical and thermal characteristics of resultant concrete is also being studied. The addition plastic granules in concrete resulting in the formation of light weight concrete.

Keywords:-*Plastic aggregates, concrete*

INTRODUCTION

The problem of disposing and managing solid waste materials in all countries has become one of the major environmental, economic, and social issues. A complete waste management system including source reduction, reuse, recycling, land-filling, and incineration needs to be implemented to control the increasing waste disposal problems. Typically, a plastic is not recycled into the Same type of plastic products made from recycled plastics are often not recyclable. The use of biodegradable plastics is increasing. If some of these get mixed in the other plastics for recycling, the reclaimed plastic not recyclable because the variance in properties and melt temperatures. The purpose of this project is to evaluate the possibility of using granulated plastic waste materials to partially substitute for the coarse aggregate in concrete composites. Among different waste fractions, plastic waste deserves special attention on account non- biodegradable property which is creating a lot of problems in the environment. In India approximately 40 million tons of solid waste is produced annually. This is increasing at a rate of 1.5 to 2% every year. Plastics constitute 12.3% of total waste produced most of which is from discarded water bottles.

PLASTIC RECYCLING

Recycling is the practice of recovering used materials from the waste stream and then incorporating those same materials into the manufacturing process. Recycling is one of the prominent is used in these environmentally conscious eras (Ha-Yong Kang et al 2005) These are three main arguments for recycling Firstly, it preserves the precious natural resources Secondly it minimizes transportation and its associated costs Thirdly, it avoids the environmental load caused by waste materials, i.e. space requirements.

Recycling Methods and Construction Applications

1. Chemical modification
2. Mechanical recycling
3. Thermal processing
4. Fillers

Chemical modifications - Plastics can be recycled by chemical modification or

depolymerization. The two ways to achieve depolymerization i.e. hydrolysis (chemical decomposition) and pyrolysis (thermal B.T. Ashwini Manjunath / Procedia Environmental Sciences 35 (2016) 731 – 739 733 decomposition). e.g.: PET (polyethylene terephthalate), MMA (methyl methacrylate).

Mechanical recycling - Mechanical recycling of plastics refers to processes which involve melting, shredding or granulation of waste plastics. Plastics must be sorted prior mechanical recycling (HDPE) high density polyethylene and thermoplastic polyolefin (TPO).

Thermal processing- Heating a thermoplastic at very high temperatures, resulting the plastic flow. As it cools and converted it into new product.

Fillers-Plastic waste can also be used as fillers with virgin resins or other materials like concrete or as fill materials in road construction.

RECYCLED PLASTIC USED IN CONSTRUCTION WORK

- Roofing Tiles
- Concrete
- Indoor Insulation
- Structural Lumber
- PVC Window
- Bricks
- Fences

PROPERTIES OF CONCETE

Properties of Fresh Concrete

- Workability
- Temperature
- Water cement Ratio
- Segregation
- Bleeding

Fig.1:-*Fresh Concrete*

MATERIAL USED

- M20 grade cement
- IS 456-2000 has specified the concrete mixes into a number of grades as M10, M15, M20, M25, M30, M35 andM40.
- Plastic Granules

In M20, M denotes Mix and 20 refers to the characteristic strength (fck) of that mix i.e. 20mpa. Cement, sand and aggregates are used for mixing in the ratio of 1:1.5:3. M20 signifies mixture of cement, sand and aggregate which are prepared in such a manner that a cement concrete cube of size 15cmx15cmx15cm is formed with characteristic strength (fck) of 20mpa while examining it after being cured for 28days.The characteristic strength (fck) signifies the strength under which not over 5% of test results are predictable to fail.

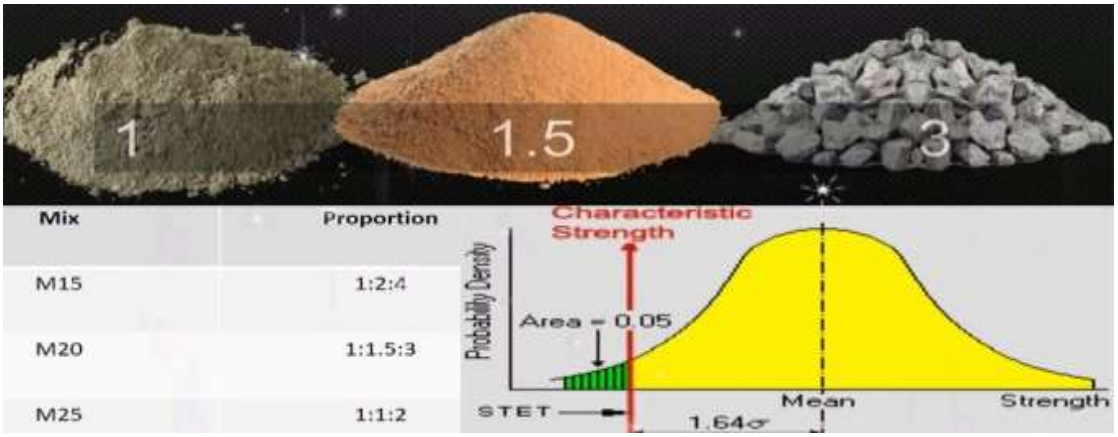


Fig.2:-*Mix proportion*

COARSE AGGREGATES

Coarse aggregates are irregular broken stones or naturally occurring round gravels that are used to make concrete, coarse aggregates for structural concrete consist of broken stones of hard rock like granite and limestone (angular aggregates) or river gravels (round aggregates).

Aggregates larger than 4.75 mm in size are termed as coarse aggregates. These aggregates are obtained from stone quarries and stone crushers, the size between 4.75mm to80mm

Fig.3:-*Coarse aggregate*

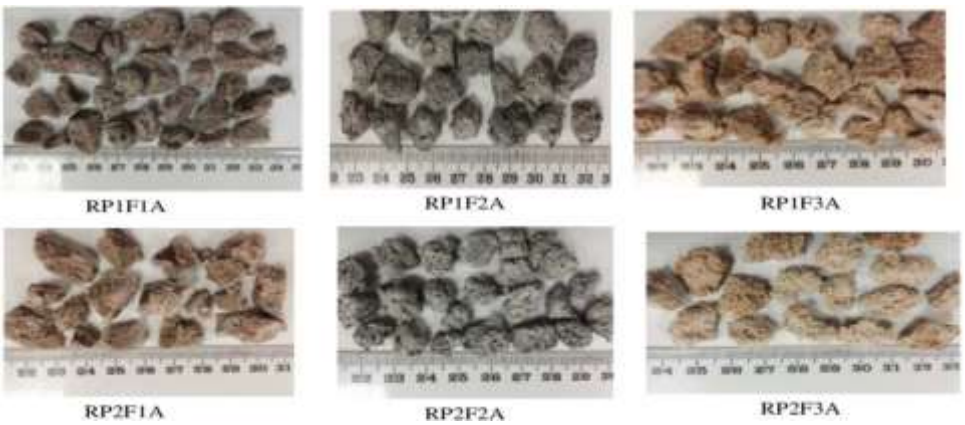
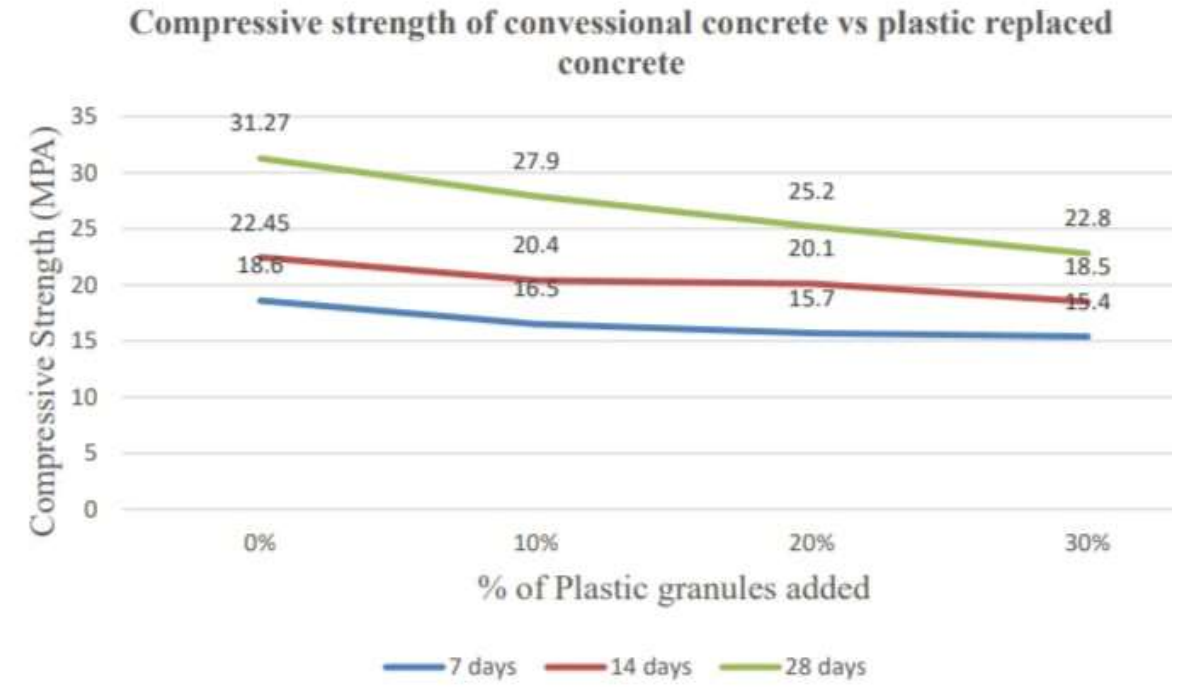


Fig.4:-*Plastic aggregates & there type*

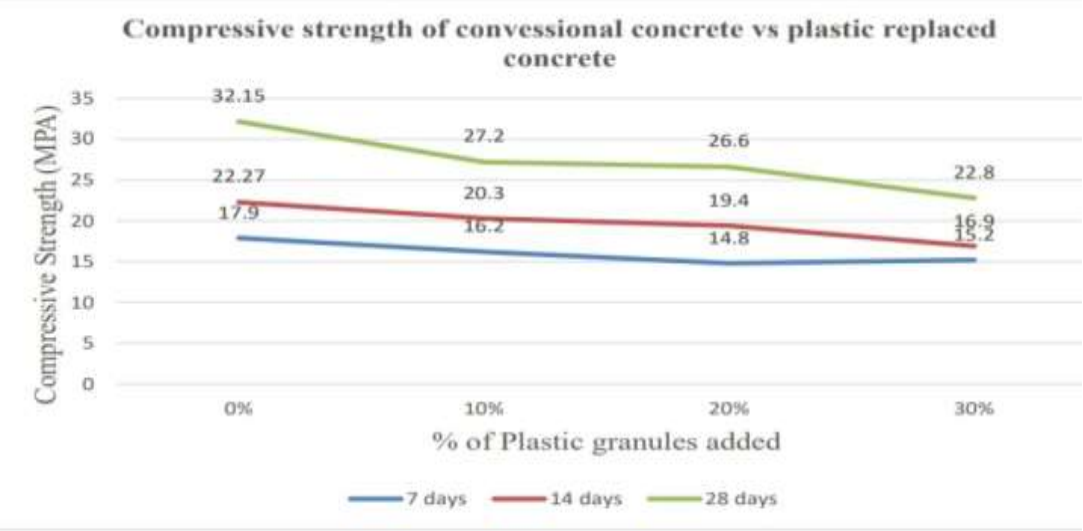
Table 1:-*Experimental Result*

% Granules added	Weight (kg)			Load (KN)			Compressive strength (MPA)		
	7th day	14th day	28th day	7th day	14th day	28th day	7th day	14th day	28th day
	8.20	8.27	8.29	418.5	505.1	703.5	18.60	22.45	31.27
0									
	8.10	8.17	8.19	402.75	501.7	723.37	17.90	22.27	32.15
	7.96	7.99	8.00	371.	391.9	562.2	16.5	20.40	27.90
10									
	8.06	7.91	7.08	321.2	502.9	612.5	16.2	20.30	27.20
	7.83	7.91	7.66	309	453.2	635.5	15.7	20.10	25.20
20									
	7.60	7.76	7.75	334.6	438.0	621.5	14.8	19.40	26.60
	7.83	7.75	7.80	373.9	416.3	739.8	15.4	18.50	22.80
30									
	7.87	7.56	7.87	387.6	380.0	742.2	15.2	16.90	23.20

❖ **Graph Shows Compressive strength of 0%, 10%, 20% and 30%**



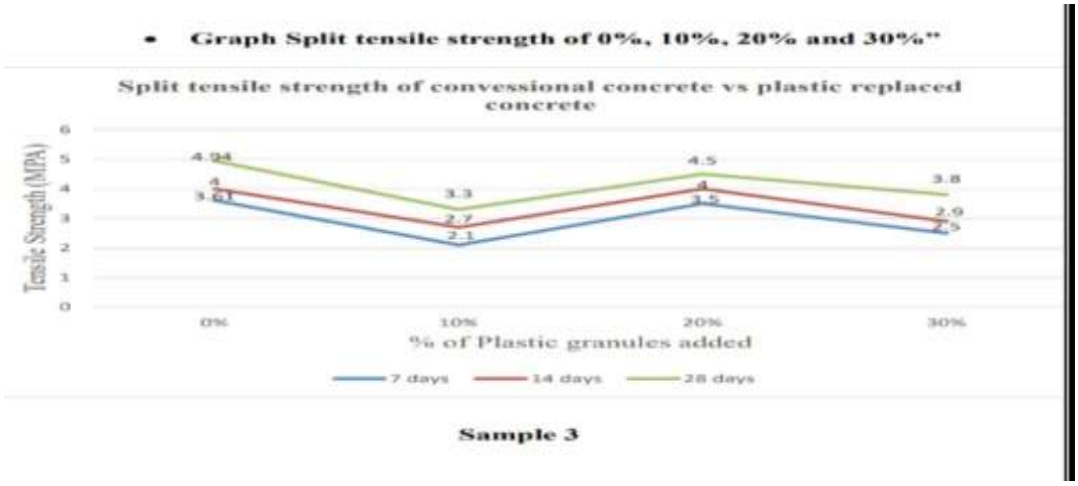
Sample 1



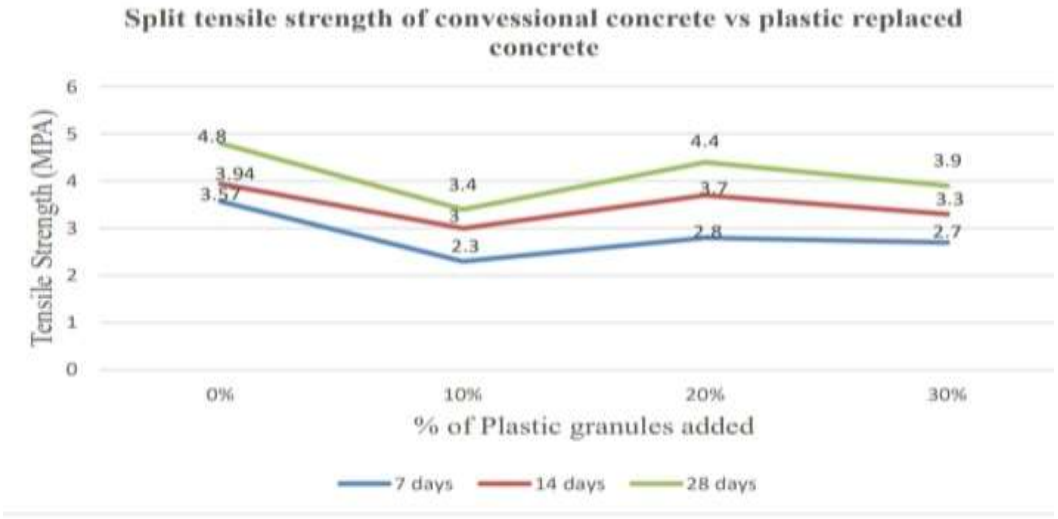
Sample 2

Table 2:-*Experimental Result*

% Granules added	Weight (kg)			Load (KN) Compressive strength (MPA)					
	7th day	14th day	28th day	7th day	14th day	28t day	7th day	14thday	28th day
	12.45	12.4	12.	165.8	183.80	226.9	3.61	4.00	4.94
		9	50	7		9			
0%									
	12.39	12.5	12.	164.0	181.04	220.5	3.57	3.94	4.80
		2	48	4		6			
	12.30	12.4	12.	96.50	123.60	150.0	2.10	2.70	3.30
		4	46			0			
10%									
	12.20	12.3	12.	103.9	135.10	154.4	2.30	3.00	3.40
		0	38	0		0			
	12.01	12.1	12.	161.3	180.30	206.2	3.50	4.00	4.50
		1	10	0		0			
0%									



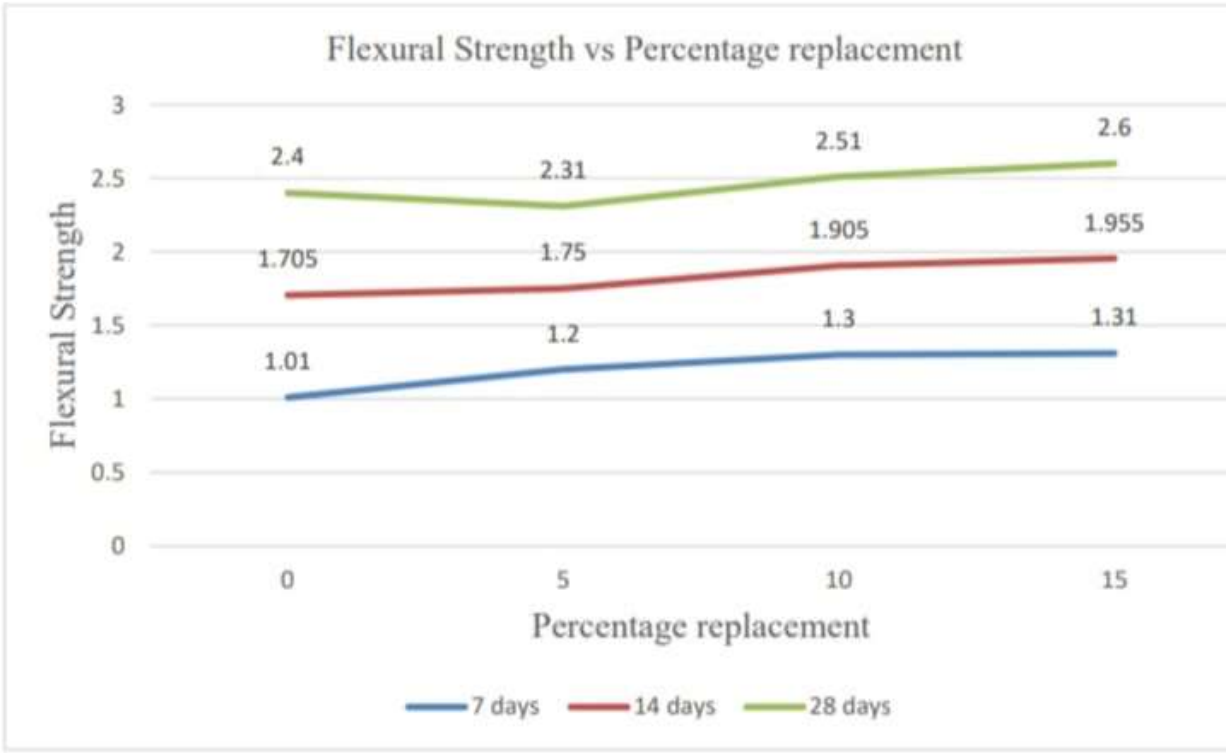
Sample 3



Sample 4

Table 3:- *Flexural Strength for 7, 14 and 28 days*

Percentage of replacement	Flexural Strength		
	7 days	14 days	28 days
0	1.01	1.705	2.4
5	1.2	1.75	2.31
10	1.3	1.905	2.51
15	1.31	1.955	2.6



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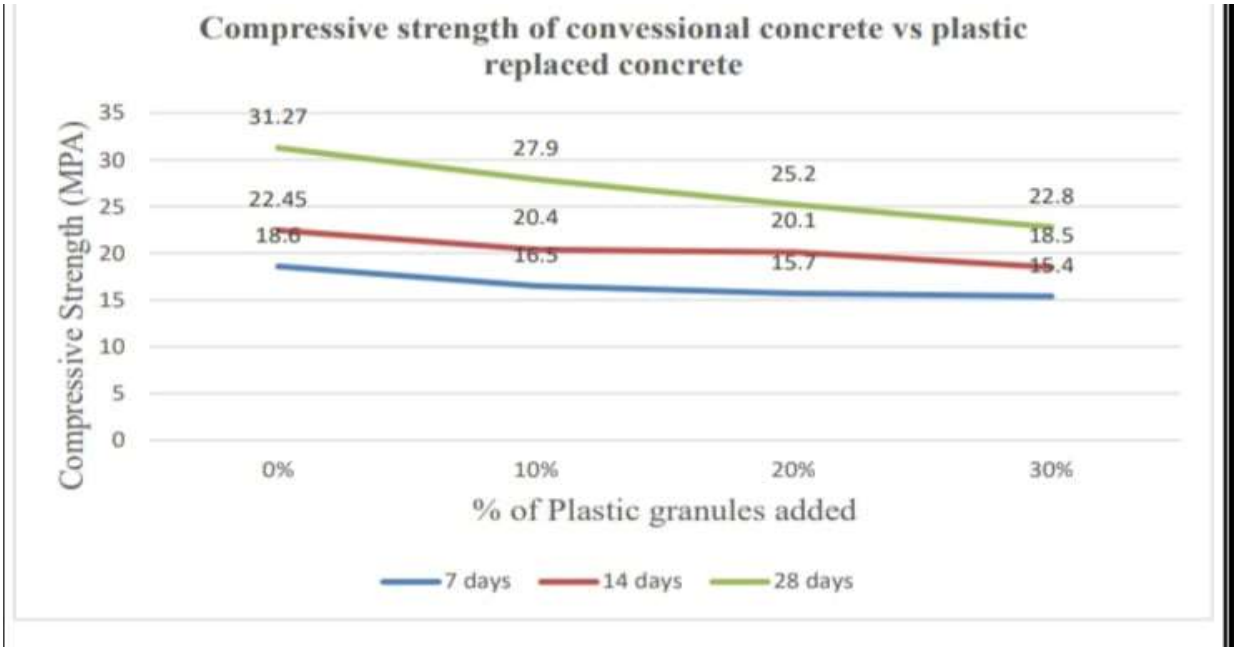

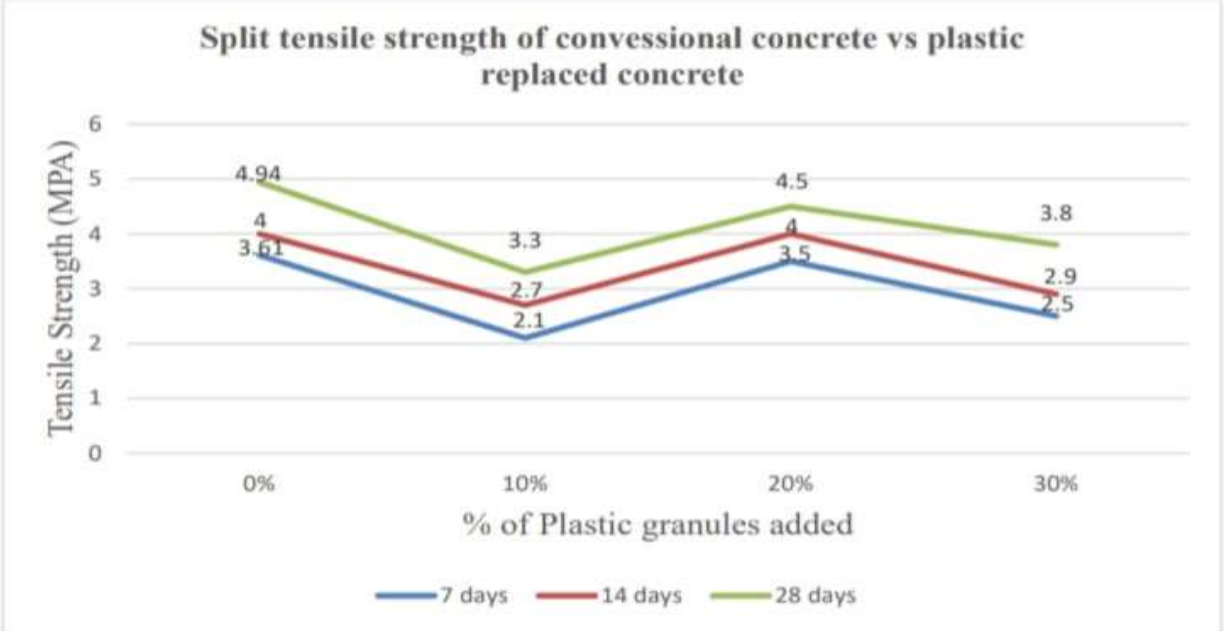

RESULT

- The properties of concrete adding different percentage of plastic (0%, 10%,20%, and 30%) were tested for its physical properties v and v compressive strength.
- The plastic used for experiments is 5-7mm size and specific gravity of waste plastic is found to be 0.92.
- The compressive strength of test concrete is compared with plain concrete and it is found that the good compressive strength is achieved for a mix of waste plastic up to 30% (as a replacement for coarse aggregate) in concrete. Hence it can be used for concrete structures.
- The mechanical properties of the test concrete did not display any notable differences depending on the color of the plastic waste.
- This research also has potential

application for the production of lightweight concrete, for minimizing the amount of polymer wastes in landfills, and the creation of decorative, attractive landscaping products.

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