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Experimental Study of strength of Concrete Cubes and Slabs by Adding Adhesives

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Abstract: *The objective was to observe the changes in the various properties of concrete blocks when additives like iron nails and shredded plastic was added to it. It was helped the disposal of waste material in a better manner in order to act it as an additive. These additives were collected from the near areas of Chandigarh. The durability properties i.e.flexural strength and compressive were evaluated. To search for new construction materials as well as a method to dispose the waste material and provide additional strengthening properties. Therefore, it can be concluded that the addition of additives in concrete is eco-friendly for the environment. The test specimen for the two tests will be prepared using M20 concrete. There various adhesives like plastic materials and iron nails will be added to the mixture and then cubes and slabs will be casted with different percentages. All the samples will be tested accordingly one by one at an interval of 7 days, 21 days and then 28 days to check the compressive strength and the flexural strength respectively. All test data, including the increase or decrease in strength will be recorded simultaneously using a data acquisition system.*

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I. Introduction

A concrete masonry unit (CMU) is a standard size rectangular block used in building construction. Concrete blocks are made from cast concrete (e.g. Portland cement and aggregate, usually sand and fine gravel, for high-density blocks). Lower density blocks may use industrial wastes, such as fly ash or bottom ash, as an aggregate. Lightweight blocks can also be produced using autoclaved aerated concrete. Concrete blocks may be produced with hollow centers (cores) to reduce weight or improve insulation. The use of block work allows structures to be built in the traditional masonry style with layers (or courses) of staggered blocks. The purpose to conduct this project is to add adhesives to the standard proportion and hence check the results for increase in compression and flexural strength of concrete blocks and slabs respectively in order to retain the waste plastic material and use it in a productive manner.

1.1 Flexural Strength

Flexural strength, also known as modulus of rupture, or bend strength, or transverse rupture strength is a material property, defined as the stress in a material just before it yields in a flexuretest. The transverse bending test is most frequently employed, in which a specimen having either a circular or rectangular cross-section is bent until fracture or yielding using a three point flexural test technique. The flexural strength represents the highest stress experienced within the material at its moment of yield. It is measured in terms of stress. The size of slab is used as 50 x 10 x 10 mm.

Flexural Strength can be determined as follows:

$$\frac{P \times L}{b \times d^2}$$

Where, P is the load applied (N)

L is the length of slab (mm)

b is the breadth of slab (mm)

d is the depth of slab (mm)

1.2 Compressive Strength

Compressive strength or compression strength is the capacity of a material or structure to withstand loads tending to reduce size, as opposed to tensile strength, which withstands loads tending to elongate. In other words, compressive strength resists compression (being pushed together), whereas tensile strength resists tension (being pulled apart). In the study of strength of materials, tensile strength, compressive strength, and shear strength can be analyzed independently.

Some materials fracture at their compressive strength limit; others deform irreversibly, so a given amount of deformation may be considered as the limit for compressive load. Compressive strength is a key value for design of structures.

Compressive strength is often measured on a universal testing machine; these range from very small table-top systems to ones with over 53 MN capacity. Measurements of compressive strength are affected by the specific test method and conditions of measurement. Compressive strengths are usually reported in relationship to a specific technical standard. The Size of cube used for testing is 15 x 15 x 15 cm.

Compressive strength can be determined as follows:

$$\frac{P}{A}$$

Where, P is the load applied (N)

A is the area of the cube (mm^2)

II. Materials and Methodology

One of the main environmental problems today is the disposal of the waste plastics. The use of plastics in various places as packing materials and the products such as bottles, polythene sheets, containers, packing strips etc., are increasing day by day. This results in production of plastic wastes from all sorts of livings from industrial manufacturers to domestic users. To circumvent this pollution crisis, many products are being produced from reusable waste plastics. On the other side, the Indian construction industry is facing problems due to insufficient and unavailability of construction materials. So, we need to search for new construction materials as well as a method to dispose the plastic waste. To find a solution to the above problems, one of them can be used to solve the other. In this experimental study, an attempt has been made to use the waste plastics in concrete and studies have been conducted to focus particularly on the behavior of compression members with various proportions of plastic wastes. The plastics used in this investigation were raw plastics (raw material used for straw manufacturing), road wastes (waste plastics collected from road sides are melted and shredded) and plastic straw. So, above plastic wastes can be mixed with cement concrete in various proportions (2% to 6%) and test specimens can be casted (cubes and slabs) to study the behavior of plastic mixed concrete in axial compression.

Whereas the iron nails are concerned, they will added to check the replacement of the natural sand concrete with the parameter including the compressive and flexural strength of the designed specimen.

III. Properties of Materials

One of the main environmental problem today is the disposal of the waste plastics. The use of plastics in various places as packing materials and the products such as bottles, polythene sheets, containers, packing strips etc., are increasing day by day. This results in production of plastic wastes from all sorts of livings from industrial manufacturers to domestic users. To circumvent this pollution crisis, many products are being produced from reusable waste plastics. On the other side, the Indian construction industry is facing problems due to insufficient and unavailability of construction materials. So, we need to search for new construction materials as well as a method to dispose the plastic waste. To find a solution to the above problems, one of them can be used to solve the other. In this experimental study, an attempt has been made to use the waste plastics in concrete and studies have been conducted to focus particularly on the behavior of compression members with various proportions of plastic wastes. The plastics used in this investigation were raw plastics (raw material used for straw manufacturing), road wastes (waste plastics collected from road sides are melted and shredded) and plastic straw. So, above plastic wastes can be mixed with cement concrete in various proportions (2% to 6%) and test specimens can be casted (cubes and slabs) to study the behavior of plastic mixed concrete in axial compression. Whereas the iron nails are concerned, they will added to check the replacement of the natural sand concrete with the parameter including the compressive and flexural strength of the designed specimen.

IV. Results and Discussion

Table 1. Flexural Test for 14 Days

Amount of Adhesive (IN %)	Load (in KN)	Strength obtained (in $N/mm^{2)}$
0	6	2.97
2	8	3.96
4	10	4.95
6	5	2.48

According to the obtained results for 14 days, we get the maximum result at 4% addition of adhesives and minimum at 6% addition of adhesives.

Table 2. Flexural Test for 21 Days

Amount of Adhesive (IN %)	Load (in KN)	Strength obtained (in N/mm$^{2)}$
0	10	4.95
2	6	2.97
4	8	3.96
6	7.5	3.74

According to the obtained results for 21 days, we get the maximum result at 0% addition of adhesives and minimum at 2% addition of adhesives.

Table 3. Flexural Test for 28 Days

Amount of Adhesive (in %)	Load (in KN)	Strength obtained (in N/mm$^{2)}$
0	11	5.45
2	7.5	3.74
4	12	5.94
6	11	5.45

According to the obtained results for 28 days, we get the maximum result at 4% addition of adhesives and minimum at 2% addition of adhesives.

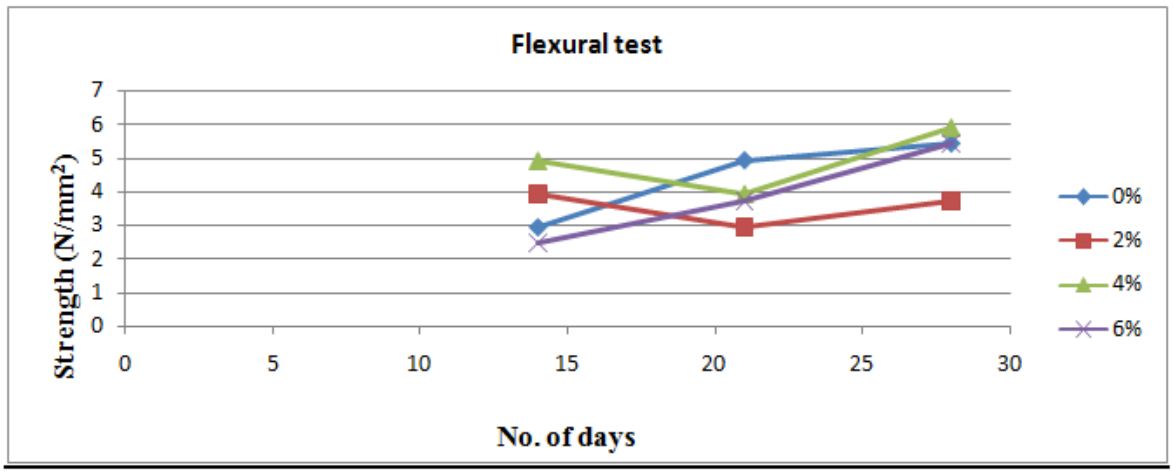


Figure 1. The graph here represents that adding adhesive for about 4% gives the best results when tested for flexural test on the 28th day.

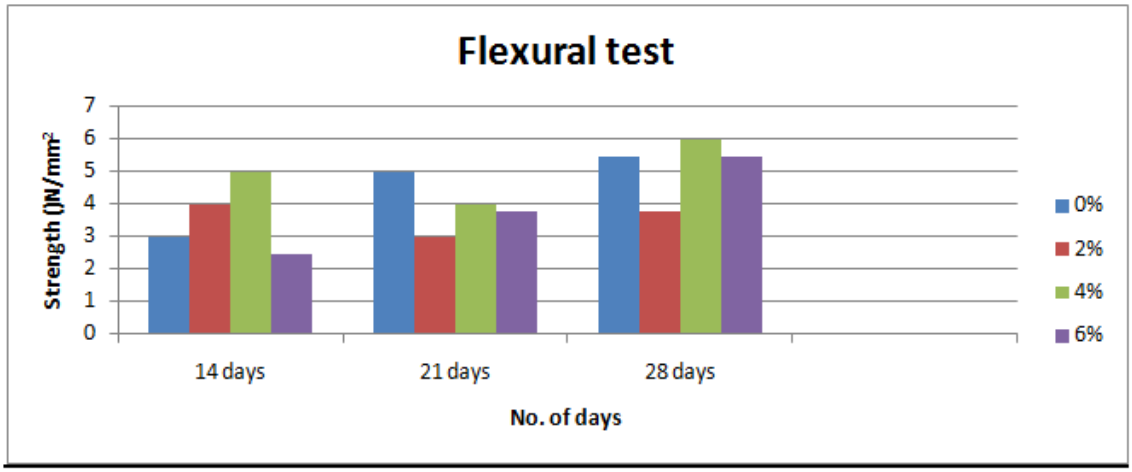


Figure 2. The figure showingmaximum value here is observed for 4% at 28 days.

Table 4. Compression Test for 14 Days

Amount of Adhesive (in %)	Load (in KN)	Strength obtained (in N/mm$^{2)}$
0	423	18.8
2	160	7.1
4	490	21.78
6	220	9.78

According to the obtained results for 14 days, we get the maximum result at 4% addition of adhesives and minimum at 2% addition of adhesives.

Table 5. Compression Test for 21 Days

Amount of Adhesive (in %)	Load (in KN)	Strength obtained (in N/mm$^{2)}$
0	410	18.2
2	530	23.56
4	430	19.11
6	260	11.5

According to the obtained results for 21 days, we get the maximum result at 2% addition of adhesives and minimum at 6% addition of adhesives.

Table 6. Compression Test for 28 Days

Amount of Adhesive (in %)	Load (in KN)	Strength obtained (in N/mm$^{2)}$
0	600	26.67
2	567	25.2
4	611	27.16
6	340	15.1

According to the obtained results for 28 days, we get the maximum result at 4% addition of adhesives and minimum at 6% addition of adhesives.

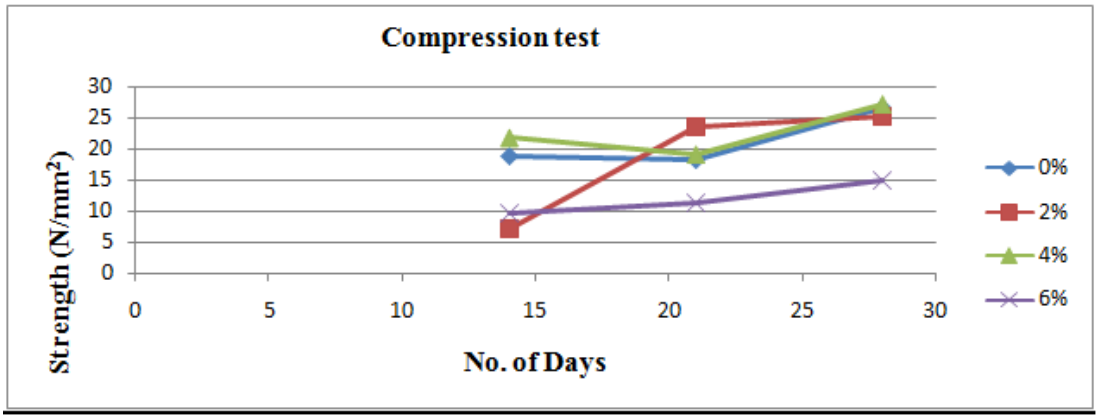
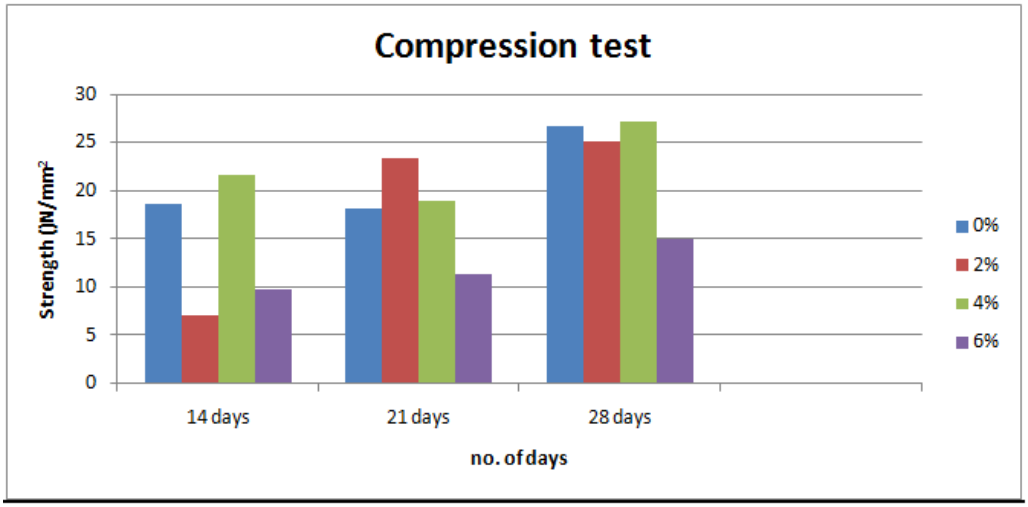


Figure 3. The graph here represents that adding adhesive for about 4% gives the best results when tested for compression test on the 28th day.



Maximum value here is observed for 4% in green bar

Amount Of Adhesive	Number Of Days	Flexural Strength Obtained (N/mm^2)	Compression Strength Obtained (N/mm^2)
0%	14	2.97	18.8
	21	4.95	18.2
	28	5.45	26.7
2%	14	3.96	7.1
	21	2.97	23.6
	28	3.74	25.2
4%	14	4.95	21.8
	21	3.96	19.1
	28	5.94	27.2
6%	14	2.48	9.8
	21	3.74	11.5
	28	5.45	15.1

As we can conclude from the highlighted values, the values attained for 4% on the 28^{th} day are maximum for both compression and flexural test as compared to 0%, 2% and 6% for 7, 14 and 21 days respectively.

V. Conclusion

Adhesives in the concrete are used due to its better performance. But in the case of higher percentage of adhesive, the concrete's strength is seen to be reduced as compared to lesser amount of adhesive added. This may affect the properties and quality of the concrete. When different percentages are added the results were observed. The respective percentages 2%, 4% and 6% were compared to 0% and results were observed.

For flexural strength:

According to the obtained results for 14 days, we get the maximum result at 4% addition of adhesives and minimum at 6% addition of adhesives.

According to the obtained results for 21 days, we get the maximum result at 0% addition of adhesives and minimum at 2% addition of adhesives.

According to the obtained results for 28 days, we get the maximum result at 4% addition of adhesives and minimum at 2% addition of adhesives.

For compressive strength:

According to the obtained results for 14 days, we get the maximum result at 4% addition of adhesives and minimum at 2% addition of adhesives.

According to the obtained results for 21 days, we get the maximum result at 2% addition of adhesives and minimum at 6% addition of adhesives.

According to the obtained results for 28 days, we get the maximum result at 4% addition of adhesives and minimum at 6% addition of adhesives.

References

[1]. Dr. S.S.Verma, IIT - Delhi, "Roads form Plastic Waste".
[2]. \Ms.R.Laksmi&Mr.Nagan, "Concrete Containing E-Wastes".
[3]. Ms. Sabina, Mr. Tabrez A Khan, Ms. Sangita, Mr. D K Sharma and Mr. B M Shanrma,"Performance evalution of waste plastic/polymer modified bituminous concrete mixces".
[4]. Mr. ShailendraMudgal& Mr. LorcanLyons."PLASTIC WASTE IN THE ENVIRONMENT – (European Commission DG ENV)".
[5]. Dr. S.S.Verma, IIT - Delhi, "Roads form Plastic Waste".
[6]. [6] Mr. Jean-Pierre Hannequart."GOOD PRACTICES GUIDE ON WASTE PLASTICS RECYCLING A GUIDE BY AND FOR LOCAL AND REGIONAL AUTHORITIES".
[7]. [7] IS: 456-2000. Plain and Reinforced Concrete Code of Practice.Bureau of Indian Standards, New Delhi.
[8]. IS: 383-1970, Specification for Coarse and Fine Aggregates from Natural Sources for Concrete. Bureau of Indian Standards, New Delhi.
[9]. Dr. S.S.Verma, IIT - Delhi, "Roads form Plastic Waste".
[10]. Ms.R.Laksmi&Mr.Nagan, "Concrete Containing E-Wastes".
[11]. Ms. Sabina, Mr. Tabrez A Khan, Ms. Sangita, Mr. D K Sharma and Mr. B M Shanrma,"Performance evalution of waste plastic/polymer modified bituminous concrete mixces".
[12]. Mr. ShailendraMudgal& Mr. LorcanLyons."PLASTIC WASTE IN THE ENVIRONMENT – (European Commission DG ENV)".
[13]. Dr. S.S.Verma, IIT - Delhi, "Roads form Plastic Waste".
[14]. Mr. Jean-Pierre Hannequart."GOOD PRACTICES GUIDE ON WASTE PLASTICS RECYCLING A GUIDE BY AND FOR LOCAL AND REGIONAL AUTHORITIES".
[15]. IS: 456-2000. Plain and Reinforced Concrete Code of Practice.Bureau of Indian Standards, New Delhi. [8] IS: 383-1970, Specification for Coarse and Fine Aggregates from Natural Sources for Concrete. Bureau of Indian Standards, New Delhi.

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