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EFFECT OF WASTE TYRE RUBBER ON MECHANICAL & DURABLE PROPERTIES OF CONCRETE

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Abstract: *Waste Tyre rubber is one of the most significant environmental hazards worldwide because of the increase in auto mobile production, there is a need to properly dispose the vast amounts of used rubber tyres. Due to the rapid growth in automobile industry. The disposal of waste tyres has facing major problems in India. The growing problem of waste tyre disposal in India can be solved if new recycling routes can be found. It is estimated that 1.2 billions of waste tyre rubber produced globally in a year.*

Hence, efforts are being made to discover the prospective use of waste-tyre rubber in construction technology. Crumb rubber is thought to be a potential material for use in concrete technology.

The use of scrap tyre rubber in the preparation of concrete has been thought as an alternative disposal of such waste to protect the environment. In this study an attempt has been made to identify the various properties necessary for the design of concrete mix with the coarse tyre rubber chips as aggregate in a systematic manner. In the present experimental investigation, the M20 grade concrete has been chosen as the reference concrete specimen. Scrap tyre rubber chips, has been used as coarse aggregate with the replacement of conventional coarse aggregate Concrete is one of the most popular building materials. The construction industry is always increases its uses and applications. Therefore, it is required to find alternative materials to reduce the cost of concrete.

On the other hand, Non-biodegradable waste Le water bottles, cool drink bottles and disposable glasses, shredded or crumbed rubber etc., is creating a lot of problems in the environment and its disposal becoming a great difficulty. The objective of this paper is to investigate the use of rubber pieces as coarse aggregate in the concrete. Concrete tested with varying percentages of rubber from 0, 10, 15, 20% of normal aggregates.

Index Terms **- Rubber Tyre Waste, Materials Required, Methodology, Test on Fresh Concrete.**

I. INTRODUCTION

During the last three decades, there have been dramatic changes in the way of thinking about industrial processes and the approach and evaluation of new and innovative materials Concrete, in its most basic form, is one of the world's oldest building materials. Concrete is a substance composed of only a few simple and commonly available ingredients that when properly mixed and cured, may last for centuries. Concrete is an evolving material as well. New techniques and methods for selecting the right quantities of those simple components are continually being presented to the design community. New ingredients to include in concrete mixes are also constantly being researched and developed. In general, concrete has low tensile strength, low ductility, and low energy absorption Concrete also tends to shrink and crack during the hardening and curing process. These limitations are constantly being tested with hopes of improvement by the introduction of new admixtures and aggregates used in the mix. One such method may be the introduction of rubber to the concrete mix. Shredded or crumbed rubber is waste being of non-biodegradable and poses severe fire, environmental and health risks.

Concrete is a mixture of cement, coarse aggregates, fine aggregates and water. Concrete is cured for 28 days to attain good strength. Various properties are linked with concrete Workability is considered as fresh concrete property, where as compressive, tensile and flexural strengths belong to hardened concrete properties. Coarse and fine aggregate used in concrete serve as filling and densifying the material. Nowadays, concrete has become the most widely used material due to easy and local availability of sand and course aggregates. But there are many drawback of using aggregates in concrete on a large scale. Course aggregates are obtained from mountains and rocks through quarry and crushing Nevertheless, these processes are hazardous and are badly damaging the environment There is a possible use of rubber tyre particles instead of coarse and find aggregate in concrete. Millions of rubber tyers become waste every year and their disposal has become a serious concem. Moreover, the burning of the waste rubber tyres becomes a cause of pollution for environment. The use of shredded rubber as a replacement for aggregates in concrete is not practised. Considering that construction uses very large amount of sand and aggregates, successful use of rubber in concrete can not only save the environment but also reduce construction costs. Tyre rubber wastes represent a major environmental problem of increasing significance. An estimated 1000 million tyres reach the end of their useful lives every year. At present enormous quantities of tyres are already stockpiled or landfills. Another alternative is an artificial reef formation but some investigation have already questioned the validity of this option. Worldwide, the production of rubber increases every year. These numbers increases with the increase in the production of vehicles. Investigations have shown that scrapped rubber tyres contain materials that do not decompose under environmental conditions and cause serious problems. One choice of decomposition is burning, but that would also results in harmful pollutions. Based on these problems, tyres can be used as aggregates in concrete. It is very difficult to manage the waste produced by the rubber-tyre industry and to handle the waste. It is not easily

biodegradable waste. The rubber waste is not easily biodegradable even after a long span passes after the landfill treatment stated that the rubber tyre waste has been utilized as fuel for the kilns, as a form of feed for the carbon black and it is also found that the environmental hazardous pollution caused by the combustion of rubber tyre in the kilns is greatly reduced as compared to the carbon black fuel. The tyre pile fires have been remaining a greater environmental problem as the fires caught by tyres are very hazardous and that the fires can burn for months, sending up an acrid black plume that is visible from various mile away.

1. MATERIAL REQUIRED

The objective is to test material and then prepare for strength test following materials are required.

1.1 CEMENT

We are using pozzolana portland cement of this project which is easily available in the local market.

Figure 1.1: Cement Bag

1.2 FINE AGGREGATE

It is material constituting of finely divided rocks and minerals with main component silica. Sand used here is of zone II confirming to IS 383;1970. Sand passing through IS steve of size 4.75mm is being used. Another material that is easily available on material shop at the rate of Rupees/kg.

Figure 1.2: Fine Aggregate

1.3 COARSE AGGREGATE

Aggregate most of which is retained on 4.75-mm IS Sieve and containing only so much finer material as is permitted for the various types described in this standard. Corse aggregate is also easily available in local market.

Figure 1.3: Coarse Aggregate

1.4 RUBBER TYRE AGGREGATE

This study has concentrated on the performance of rubber tyre as partial replacement of coarse aggregate. Rubber tyre aggregate is prepared by manual cutting. The maximum sure of the rubber aggregate was 20 mm. Rubber tyre is a waste which is easily available but the required size was obtained by manual cutting.

Figure 1.4: Rubber Tyre Aggregate

1.5 WATER

This is the least expensive but most important ingredient of mortar. The water which is used for making mortar, should be clean and free from harmful impurities such as oil, alkali, acid, etc., in general, the water, which is fit for drinking should be used for making mortar. Easily available and cost free.

Figure 1.5: Water

2. METHODOLOGY

- Material Collection
- Testing of Material
- Material Mix According to Nominal Mix Design
- Moulding
- Curing
- Testing Of Cubes
- Result and Discussion
- Conclusion

3. MATERIAL FOR THREE CUBE TEST ON 0% REPLACEMENT OF COARSE AGGREGATE

MATERIAL	QUANTITY
Cement	6 Kg
Fine Aggregate	6 Kg
Coarse Aggregate	12 Kg
Rubber Tyre Waste	0 Kg
Water	0.48 Kg

Table 3.1: Material for Three Cube Test on 0% replacement of coarse aggregate

3.1 MATERIAL FOR THREE CUBE TEST ON 10% REPLACEMENT OF COARSE AGGREGATE

MATERIAL	QUANTITY
Cement	6 Kg
Fine Aggregate	6 Kg
Coarse Aggregate	10.8 Kg
Rubber Tyre Waste	1.2 Kg
Water	0.48 Kg

Table 3.1.1: Material for Three Cube Test on 10% replacement of coarse aggregate

3.2 MATERIAL FOR THREE CUBE TEST ON 15% REPLACEMENT OF COARSE AGGREGATE

MATERIAL	QUANTITY
Cement	6 Kg
Fine Aggregate	6 Kg
Coarse Aggregate	10.2 Kg
Rubber Tyre Waste	1.8 Kg
Water	0.48

Table 3.2.1: Material for Three Cube Test on 15% replacement of coarse aggregate

3.3 MATERIAL FOR THREE CUBE TEST ON 20% REPLACEMENT OF COARSE AGGREGATE

MATERIAL	QUANTITY
Cement	6 Kg
Fine Aggregate	6 Kg
Coarse Aggregate	9.6 Kg
Rubber Tyre Waste	2.4 Kg
Water	0.48

Table 3.3.1: Material for Three Cube Test on 20% replacement of coarse aggregate

4. TEST ON FRESH CONCRETE

4.1 SLUMP TEST

- The concrete slump test measures the consistency of fresh concrete before it sets.
- It is performed to check the workability of freshly made concrete.
- According to IS- 1199:1959 , Slump range- 5mm to 260mm.

Figure 4.1.1: Slump Apparatus

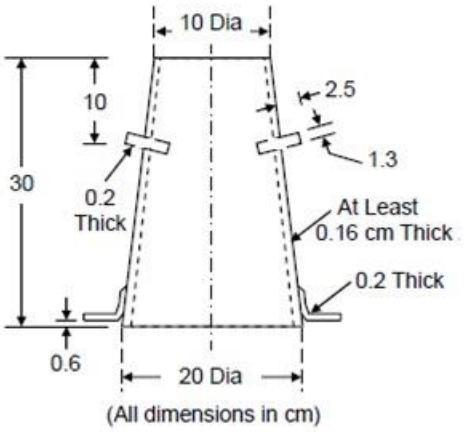

Figure 4.1.2: Slump Apparatus (Dimentions)

Figure 4.1.3: Tamping Of Concrete

Figure 4.1.4: Taking Value on Tamping Rod

5. RESULTS AND DISCUSSION

5.1 TEST RESULTS OF CONCRETE (WORKABILITY TEST)

SPECIMEN	% RUBBER TYRE	SLUMP (mm)
A	0	105
A1	10	92
A2	15	75
A3	20	65

Table 5.1.1: Workability Test for Different Rubber Tyre Content

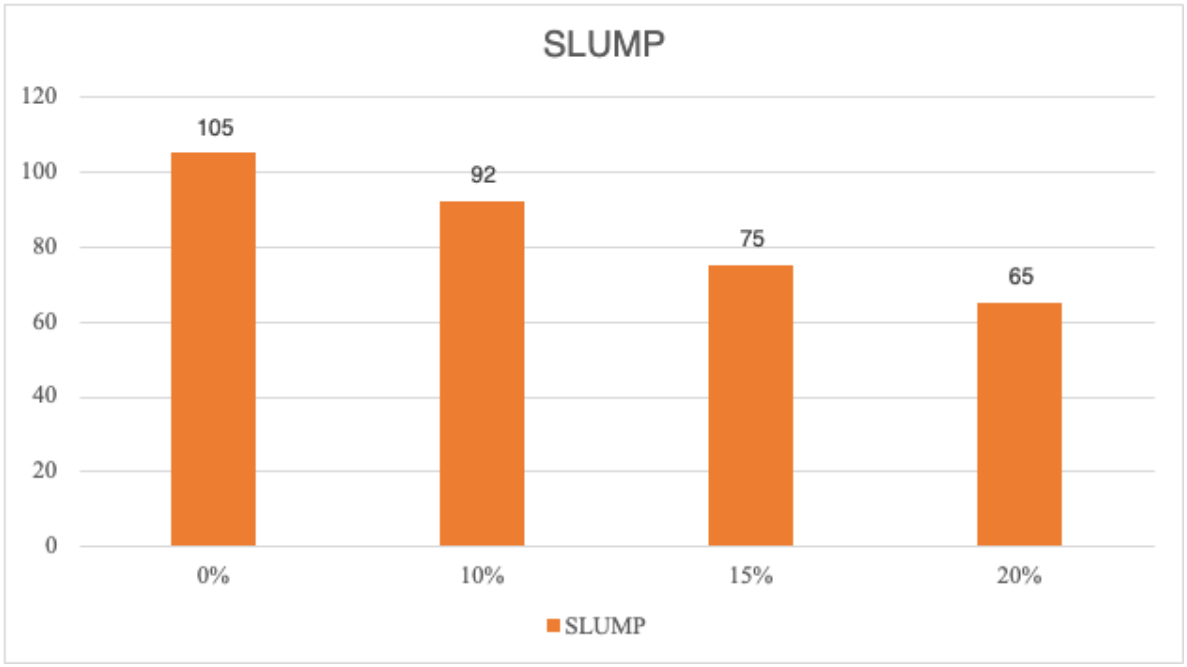

Figure 5.1.2: Slump

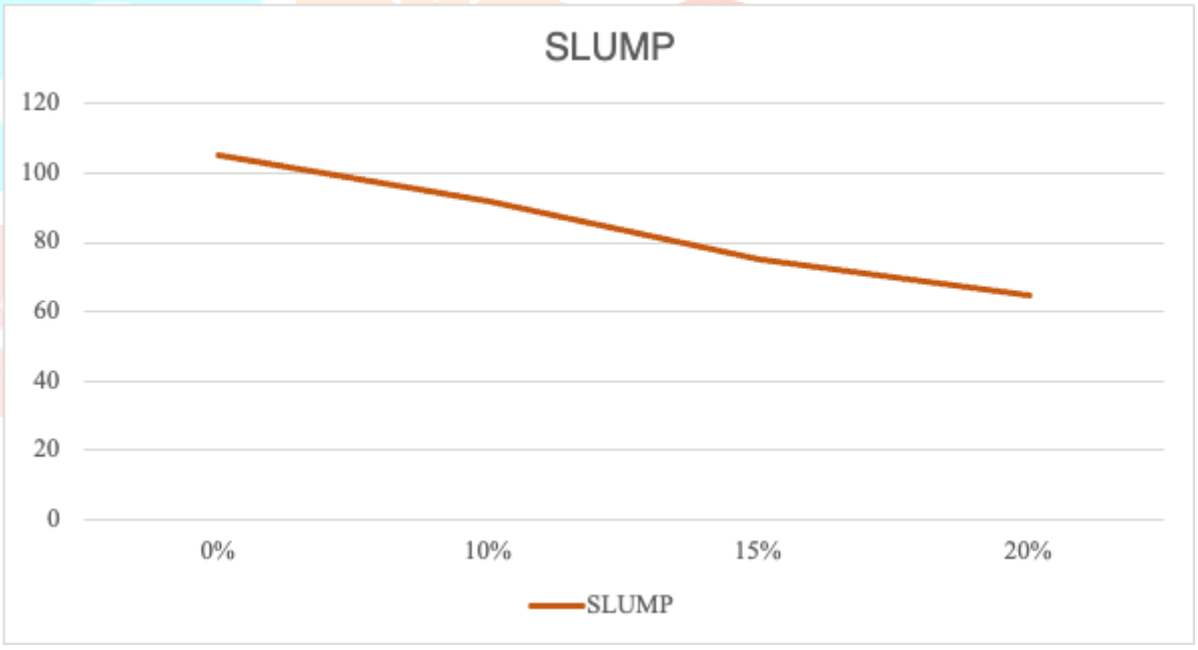

Figure 5.1.3: Slump

NOTE: The optimum content of rubber tyre aggregate as partial replacement of aggregate is upto 10% because compressive strength of concrete reduce when we add the percentage of rubber tyre aggregate as partial replacement of coarse aggregate in concrete.

5.2 COMPRESSIVE STRENGTH TEST RESULTS OF CONCRETE CUBES IN 7 DAYS

	A	A1	A2	A3
SAMPLE 1	17.78	15	13	9
SAMPLE 2	16.89	16.05	13.85	10.25
SAMPLE 3	17.79	14	13	10.15
AVERAGE	17.48	15.01	13.28	9.8

Table 5.2.1: Compressive Strength Test Results of Concrete Cubes in 7 Days

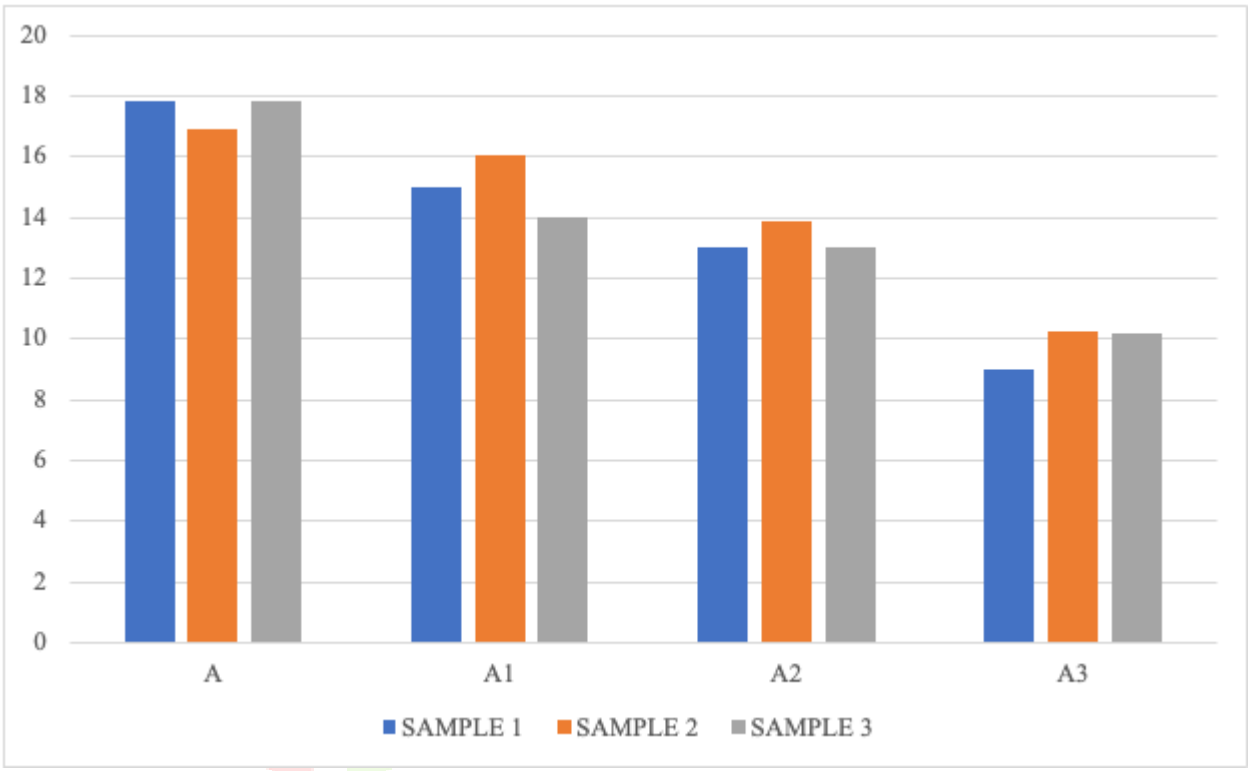

Figure 5.2.2: Graphical Representation of Compressive Strength Test Results of Concrete Cubes in 7 Days

5.3 COMPRESSIVE STRENGTH TEST RESULTS OF CONCRETE CUBES IN 28 DAYS

	A	A1	A2	A3
SAMPLE 1	25.77	16.3	13.75	11.4
SAMPLE 2	26.67	18.4	17	10.95
SAMPLE 3	28.89	19.45	14.35	12.85
AVERAGE	27.11	18.05	15.03	11.73

Table 5.3.1: Compressive Strength Test Results of Concrete Cubes in 28 Days

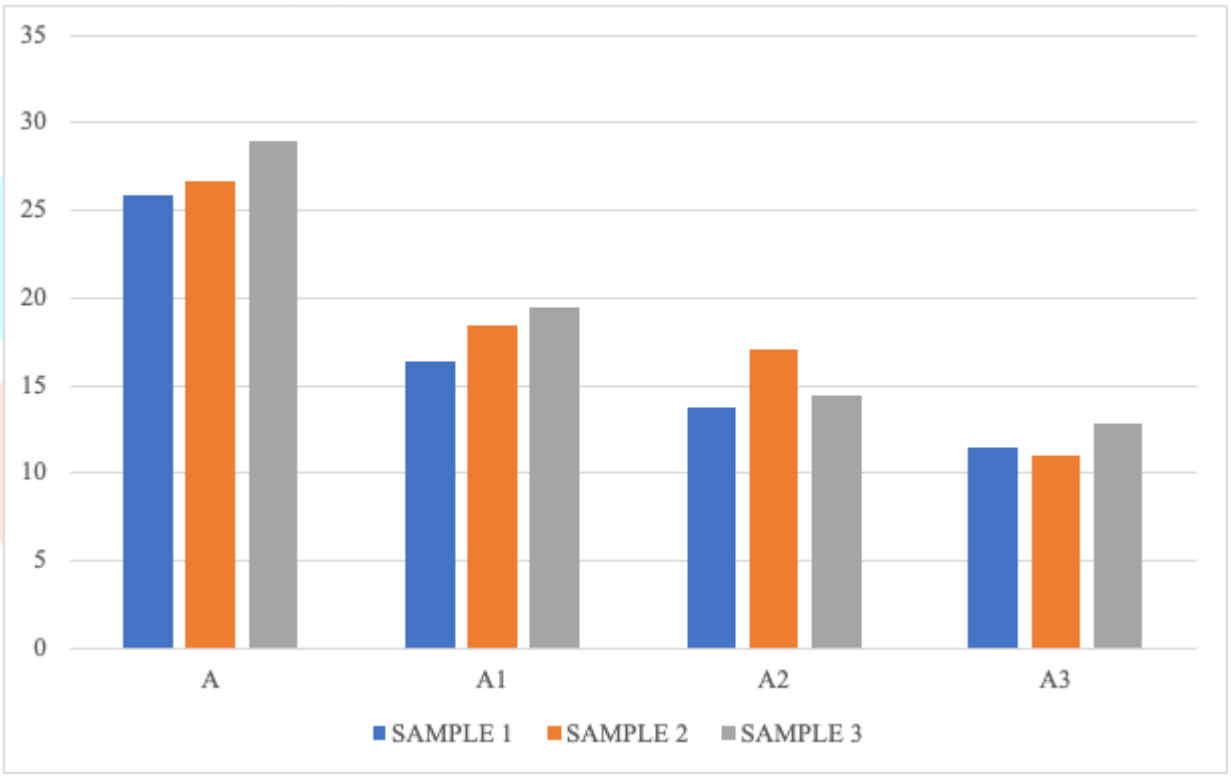

Figure 5.3.2: Graphical Representation of Compressive Strength Test Results of Concrete Cubes in 28 Days

6. CONCLUSION

From the test results of various mix samples, the following are drawn-

- Introduction of recycled rubber tyres into concrete mix leads to decrease in slump and workability for the various samples.
- Rubberized concrete can be used in non- load bearing members i.e., light weight concrete walls, other light architectural units, thus rubberized concrete mixes could give a variable alternative to where the requirements of normal loads, low unit weight, medium strength, high toughness etc.
- Fine and coarse aggregates of rubber increase workability of fresh concrete.
- The compressive strength of concrete with rubber decreased with increase of curing time.

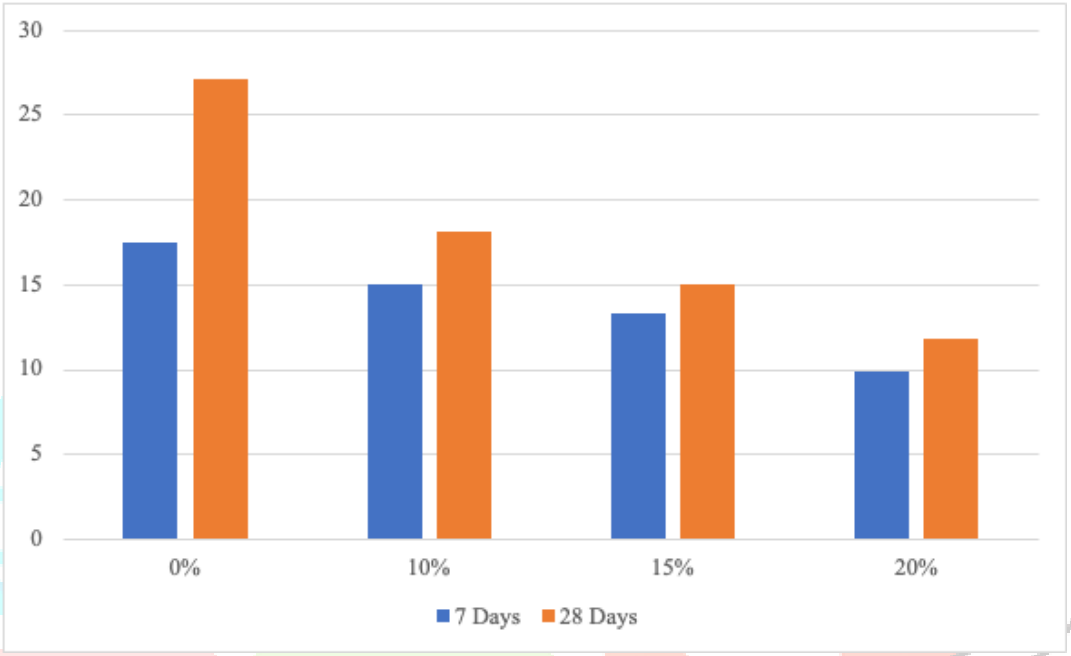

Figure 6.1: Compressive Strength

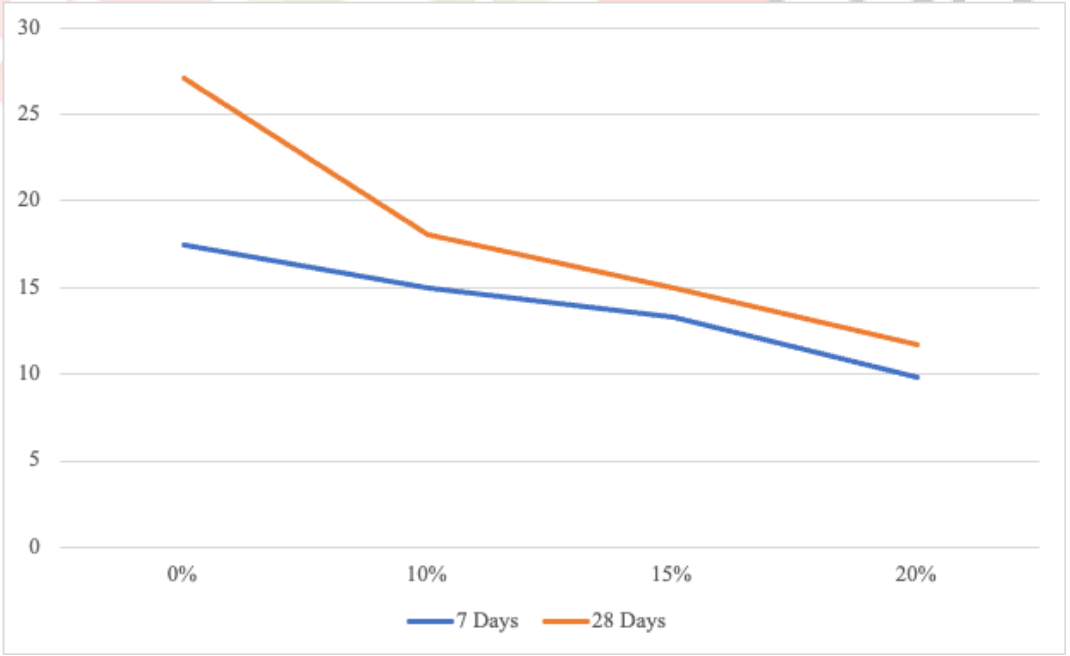

Figure 6.2: Compressive Strength

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