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UTILIZATION OF PLASTIC BAGS IN CONCRETE TO IMPROVE ITS PROPERTIES

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Abstract: Since 1950 to 2018, approximately 6.3 billion tones of plastic were manufactured worldwide, with 9% and 12% of that being recycled and burnt respectively. With the increase in population, the demand for plastic products has also increased which generate the plastic waste. Plastic waste not only hazardous to the human life but also adversely affects the environment. Annually, about 8 million tones of plastic are thrown into the water bodies, causing habitat degradation and eventually affectingaquatic animals. Long-term use and high-temperature exposure of plastic and plastic items can cause harmful chemical elements to leak into food, drinks, and water. There are different types of plastic generated every year. In this study plastic bags are used in concrete to improve the properties of concrete mix. Varying percentage of plastic i.e. 0%, 0.25%, 0.45%, 0.65%, 0.85%, 1.00% is added in the concrete mix and compressive strength test and split tensile strength was conducted on the specimen to check the properties of concrete.

Key words **– Plastic bags, Compressive strength, Split tensile strength, Plastic waste.**

1. INTRODUCTION

Waste has become a global issue that must be tackled in order to resolve the world's resources and energy issues. Every minute, one million plastic drinking bottles are buying around the world and 5 trillion plastic bags are used annually. Half of all plastic generated is intended to be used only once and then discarded.

Land, water streams, and oceans can all be affected by plastic waste. Annually approximately 1.1 to 8.8 million tonnes of plastic garbage is expected to enter the water bodies from the people who live near to ocean. As of the end of 2013, it was predicted that 86 million tonnes of plastic marine debris had accumulated in the world's oceans, based on the premise that 1.4 percent of global plastic generated from 1950 to 2013 had reached the ocean and gather there. According to some estimates, by 2050 there may be more plastic in the oceans than fish.

A fresh report titled "Plastic and Climate" was released in 2019. According to this report, the manufacture and incineration of plastic will emit greenhouse gases i.e. 850 tonnes of carbon dioxide in environment in 2019.Annual emissions from these sources will reach 1.34 billion tonnes by 2030 if current trends continue. Plastic might emit 56 billion tonnes of greenhouse gases by 2050, accounting for up to 14% of the plant's remaining carbon budget.

Plastic waste on land is dangerous to the plants, animals including humans. Plastic concentrations on land are found to be 4 to 23 times higher than in the water. The amount of plastic accumulating on land is larger and more concentrated than that found in water. Chlorinated plastic can emit hazardous chemicals into the soil, which can eventually mix into groundwater or other nearby water sources, affecting the global ecology. Animals and humans that drink the water may suffer catastrophic consequences as a result of this.

2. MATERIALS

2.1. Cement

Ordinary Portland cement of 43 grades was used for this experimental work. Some tests were performed on cement to check the properties of cement as shown in Table 2.1.

Table 2.1 Properties of cement

S.No.	Properties of cement	Results	Results as per IS Code 8112-1989
1	Consistency	29.5%	
2	Initial setting Time	45 minutes	30 minutes (minimum)
3	Final Setting Time	300 minutes	600 minutes or 10 hours (maximum)
4	Specific Gravity	3.12	3.1-3.16g/cc
5	3rd day Compressive strength	24 N/mm^2	-
6	7th day Compressive strength	35.1 N/mm^2	-
7	28th day Compressive strength	44.5 N/mm^2	-

2.2. Fine Aggregates

For this experimental work, natural river sand was utilized. As per IS code 2386 (Part-1), some test were conducted to determine the properties of sand as shown in Table 2.2.

Table 2.2 Properties of Fine aggregates

S.No.	Physical Properties	Results
1	Specific Gravity	2.65
2	Fineness Modulus	2.7
3	Water Absorption	0.66%
4	Free Moisture Content	0.25%

2.3. Coarse Aggregate

In this work, crushed granite stones were used as a coarse aggregate. The size of coarse aggregates varies between 10 mm to 20 mm. Before making the samples testing of aggregates were performed as per IS Code: 383-1970.

Table 2.3 Properties of coarse aggregate

S.No.	Physical Properties	Results
1	Specific Gravity	2.68
2	Fineness Modulus	2.9
3	Water absorption	0.6%
4	Aggregate Impact Value	13%
5	Aggregate Crushing Value	24%

2.4. Water

Portable water was used for preparing the concrete mix and curing the cubes as per IS-456-2000. Water should be free from any impurities i.e. chemical, salt, dust particles, stones, wood etc.

2.5. Plastic bags

Plastic bags i.e. Polythene bags were used in concrete mix. Polythene bags were cut into small pieces so that they could mix properly in the concrete mix. Polythene bags were collected from the home and then utilized in concrete mix.

3. CONCRETE MIX PROPORTION

The very first step of any experimental research work is to design the mix proportion. In this work designing of M25 is done with w/c ratio 0.45. Six mixes with varying percentage of plastic were prepared in order to obtain the results.

Table 3. Concrete mix proportion

S.No.	Concrete Type	w/c ratio	Percentage of plastic
1	Conventional Concrete	0.45	0%
2	Concrete with plastic	0.45	0.25%
3	Concrete with plastic	0.45	0.45%
4	Concrete with plastic	0.45	0.65%
5	Concrete with plastic	0.45	0.85%
6	Concrete with plastic	0.45	1.00%

4. PREPARATION AND CASTING OF CUBES

Preparation of concrete mix and then casting of cubes should be done with great accuracy. In this research work, the materials i.e. cement, sand, aggregates and plastic bags were used. For casting of the cubes 150 x 150 x 150mm size moulds were used. Cement is a binding material in all the above mentioned materials and OPC 43 grade cement was used for making the concrete mix. Sand is used as per I.S 383-1970. The very first step was to sieve the sand through 4.75mm size sieve and to make it moisture free it was then put into over for drying at the temperature 100°c.Aggregates that are locally available of size ranging from 10mm to 20mm were used in concrete mix. To get the desired results mixing of allthe material should be done properly and carefully. Plastic bags cut into small pieces were used in the concrete mix. Water without any impurities was used to mix all the ingredients. Concrete mixture is then filled in mould in three layers and compacted each layer with tapping rod and vibration machine was used to remove the voids. Cube samples were kept in a room for 24 hours and taken out from the mould after 24 hours. Samples were put into water for curing for 7, 14 and 28days.

5. RESULTS AND DISCUSSION

5.1. Compressive Strength Test

Compressive strength test was performed on cubes to check the strength of samples. Compressive strength for three cube samples of size 150mm x 150mm x 150mm were checked and average result was taken. The strength of each cube was checked after 7^{th}, 14^{th} and 28^{th} days respectively as shown in Table 5.

Table 5.1 Compressive Strength Results of concrete cubes (N/mm^2)

Mix Type	7^{th} (N/mm^2)	14^{th} (N/mm^2)	28^{th} (N/mm^2)
Conventional Concrete (0%)	17.1	21.2	26.82
Concrete with 0.25% plastic	14.89	19.12	24.01
Concrete with 0.45% plastic	13.76	18.25	23.22
Concrete with 0.65% plastic	12.45	16.24	21.56
Concrete with 0.85% plastic	10.27	14.61	20.49
Concrete with 1.00% plastic	9.09	12.89	19.7

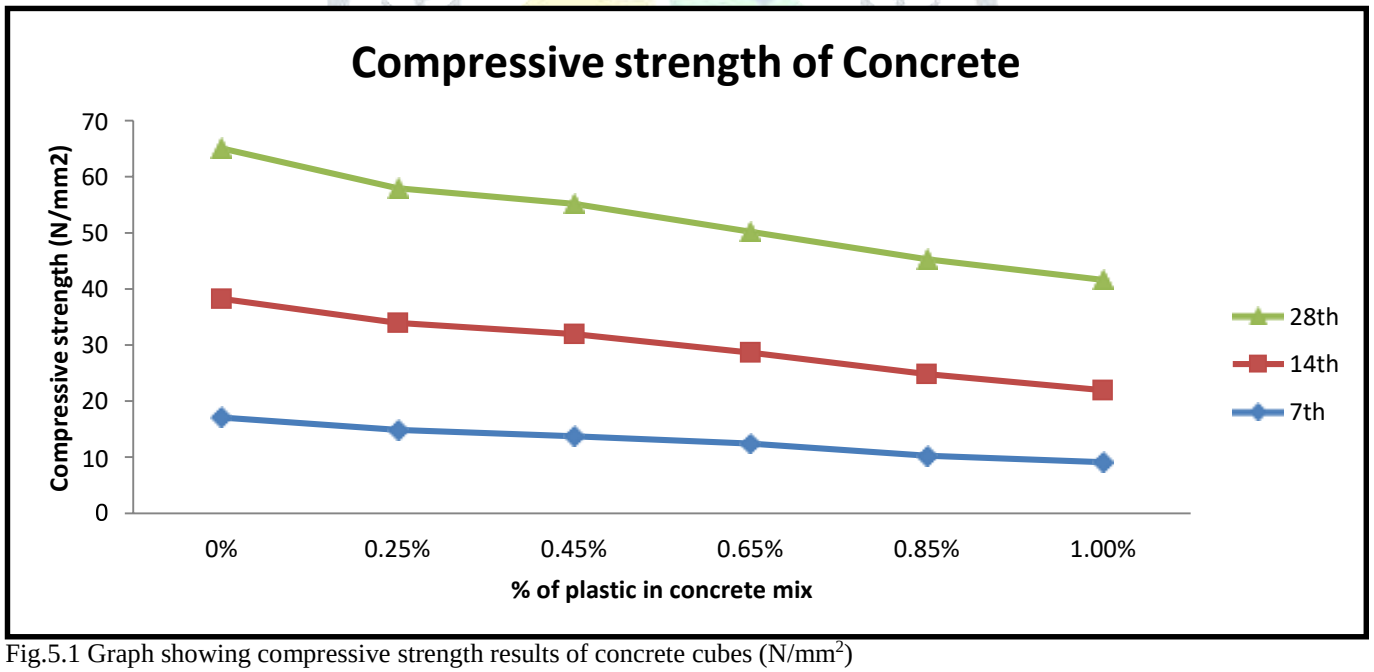

Fig.5.1 Graph showing compressive strength results of concrete cubes (N/mm^2)

5.2. Split Tensile Strength

The important property of concrete is tensile strength. Concrete is weak in tension and good in compression. For checking the split tensile strength of concrete, cylindrical sample of diameter 150mm and length 300m was tested. Cylindrical samples were tested on 3rd, 7th and 28 days.

Table 5.2 Split Tensile Strength Results of concrete cubes (N/mm^2)

Mix Type	7th day (N/mm^2)	14th day (N/mm^2)	28th day (N/mm^2)
Concrete with 0.25% plastic	2.23	2.87	2.99
Concrete with 0.45% plastic	2.42	2.91	3.24
Concrete with 0.65% plastic	2.6	2.99	3.28
Concrete with 0.85% plastic	2.32	2.89	3.01
Concrete with 1.00% plastic	2.05	2.7	2.92

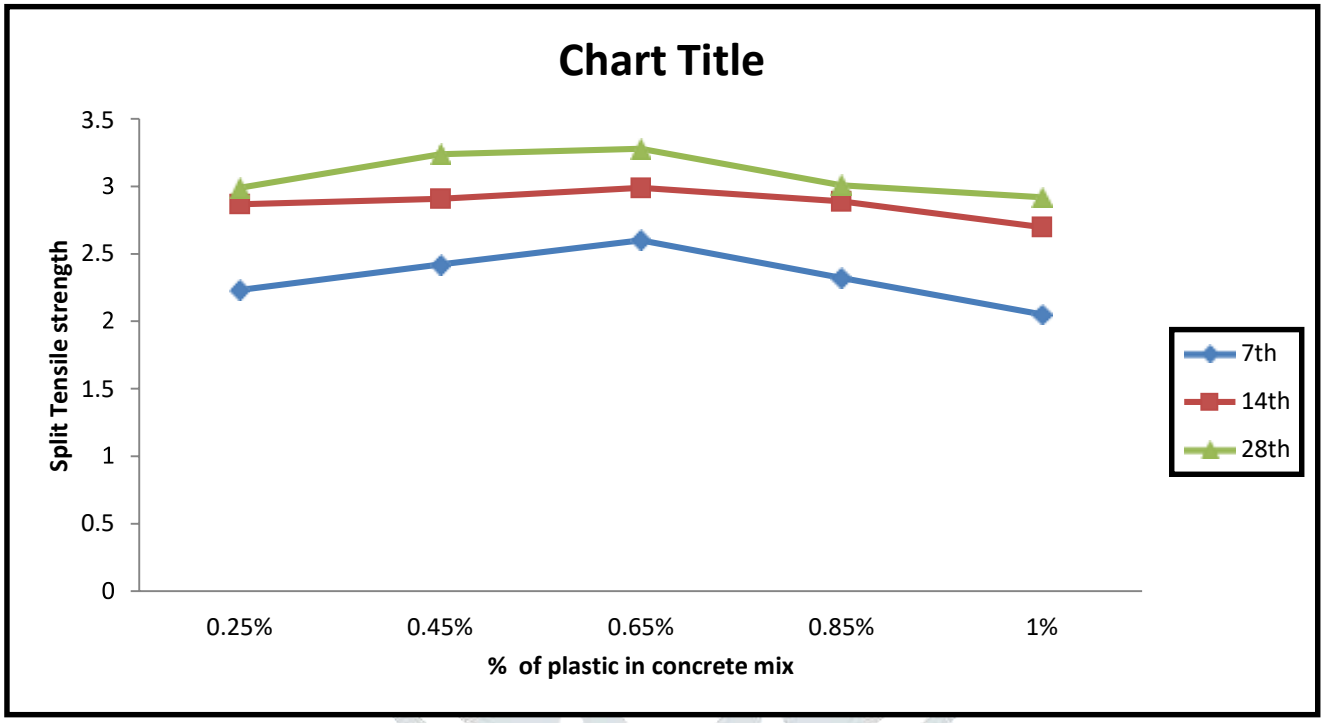

Fig.5.2 Graph showing split strength results of concrete cubes (N/mm^2)

6. Conclusion

In this research paper property like compressive strength, split tensile strength of concrete has been checked and the following conclusion made:

- It was observed that compressive strength of concrete was initially increased but with the increase in percentage of concrete it started decreasing.
- Optimum results were found in concrete with 0.25% plastic.
- The compressive strength of concrete with 0.25% plastic at 28th day was found to be 24.01 N/mm^2.
- Split tensile strength test was performed on the concrete sample and the optimum split tensile strength of concrete with 0.65% plastic at 28th day was found 3.28 N/mm^2.

REFERENCES

[1] Abdel Tawab, O.F., Amin, M.R., Ibrahim, M.M., Abdel Wahab, M. and Abd El Rahman, E.N., 2020. Recycling Waste Plastic Bags as a Replacement for Cement in Production of Building Bricks and Concrete Blocks. *J Waste Resour Recycl*, *1*(2), p.202.

[2] Al-Hadithi, A.I. and Hilal, N.N., 2016. The possibility of enhancing some properties of self-compacting concrete by adding waste plastic fibers. *Journal of Building Engineering*, *8*, pp.20-28.

[3] Bhogayata, A.C. and Arora, N.K., 2017. Fresh and strength properties of concrete reinforced with metalized plastic waste fibers. *Construction and Building Materials*, *146*, pp.455-463.

[4] Chaudhary, M., Srivastava, V. and Agarwal, V., 2014. Effect of waste low density polyethylene on mechanical properties of concrete. *Journal of Academia and Industrial Research (JAIR) Volume*, *3*, pp.123-126.

[5] Ghernouti, Y., Rabehi, B., Safi, B. and Chaid, R., 2011. Use of recycled plastic bag waste in the concrete. *Journal of International Scientific Publications: Materials, Methods and Technologies*, *8*, pp.480-487.

[6] Hossain, M.B., Bhowmik, P. and Shaad, K.M., 2016. Use of waste plastic aggregation in concrete as a constituent material. *Progressive Agriculture*, *27*(3), pp.383-391.

[7] Ismail, Z.Z. and Al-Hashmi, E.A., 2008. Use of waste plastic in concrete mixture as aggregate replacement. *Waste management*, *28*(11), pp.2041-2047.

[8] Jain, A., Siddique, S., Gupta, T., Jain, S., Sharma, R.K. and Chaudhary, S., 2019. Fresh, strength, durability and microstructural properties of shredded waste plastic concrete. *Iranian Journal of Science and Technology, Transactions of Civil Engineering*, *43*(1), pp.455-465.

[9] Jain, A., Siddique, S., Gupta, T., Sharma, R.K. and Chaudhary, S., 2020. Utilization of shredded waste plastic bags to improve impact and abrasion resistance of concrete. *Environment, Development and Sustainability*, *22*(1), pp.337-362.

[10] Kamaruddin, M.A., Abdullah, M.M.A., Zawawi, M.H. and Zainol, M.R.R.A., 2017, November. Potential use of plastic waste as construction materials: recent progress and future prospect. In *IOP Conference Series: Materials Science and Engineering* (Vol. 267, No. 1, p. 012011). Iop Publishing.

[11] Marzouk, O.Y., Dheilly, R.M. and Queneudec, M., 2007. Valorization of post-consumer waste plastic in cementitious concrete composites. *Waste management*, *27*(2), pp.310-318.

[12] Patil, P.S., Mali, J.R., Tapkire, G.V. and Kumavat, H.R., 2014. Innovative techniques of waste plastic used in concrete mixture. *International Journal of Research in Engineering and Technology*, *3*(9), pp.29-32.

[13] Raghatate Atul, M., 2012. Use of plastic in a concrete to improve its properties. *International journal of advanced engineering research and studies*, *1*(3), pp.109-111.

[14] Rai, B., Rushad, S.T., Kr, B. and Duggal, S.K., 2012. Study of waste plastic mix concrete with plasticizer. *International Scholarly Research Notices*, *2012*.

[15] Sambhaji, P.P., 2016. Use of waste plastic in concrete mixture as aggregate replacement. *International Journal of Advanced Engineering Research and Science*, *3*(12), p.236956.

[16] Sambhaji, P.P., 2016. Use of waste plastic in concrete mixture as aggregate replacement. *International Journal of Advanced Engineering Research and Science*, *3*(12), p.236956.

[17] Sharma, R. and Bansal, P.P., 2016. Use of different forms of waste plastic in concrete–a review. *Journal of Cleaner Production*, *112*, pp.473-482.

[18] Thorneycroft, J., Orr, J., Savoikar, P. and Ball, R.J., 2018. Performance of structural concrete with recycled plastic waste as a partial replacement for sand. *Construction and Building Materials*, *161*, pp.63-69.