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Application of Plastic Waste in Partial Replacement of Concrete

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ABSTRACT: Plastic bags which are commonly used for packing, carrying vegetables, meat etc. creates a serious environmental problem. Plastic bag last in environment up to 1000 years because of plastic bag last so long the number of plastic bag accumulated increases each year. Disposal of large quantity of plastic bag may cause pollution of land, water bodies and air. The proposed concrete which is made up by adding plastic in concrete may help to reuse the plastic bag as one of the constituent's material of concrete, to improve the certain properties of concrete. The properties of concrete containing varying percentages of plastic were tested for compressive strength and Split tensile strength and shows that an appreciable improvement in tensile strength of concrete can be achieved by introducing cut pieces of plastic bags.

KEYWORDS: Compressive Strength Split Tensile Strength, Plastic Bag, And Environmental Problems, etc.

I. INTRODUCTION

Generation of plastic waste is one of the fastest growing areas. Every year more than 500 billion plastic bags are used (nearly one million bags per minute). Hundreds of thousands of seas turtles, whales and other marine mammals die every year from eating discarded plastic bag for mistaken food. On land many animals suffer from similar fate to marine life. Collection, hauling and disposal of plastic bag waste creates an additional environmental impact. In a landfill or in environment, Plastic bags take up to 1000 year to degrade. Many researches were conducted to use industry by products such as fly ash, silica of concrete. R.Lakshmi and S. Nagan suggested the use of E-Plastic particles along with fly ash to improve the properties of concrete. Dr. M. Shivraja used the coir fibers as concrete composites for disaster prone structures. Flume, glass cullet, fibers, e-plastic waste in concrete to improve the properties

II. RESEARCH SIGNIFICANCE

Plastic bags which are used for carrying goods become a waste after use and create environmental problems. Large amount of plastic waste produced every year. Recycle and reused of plastic require vast manpower and processing cost thus the very small amount of plastic recycled and reused and rest going into landfills, incinerators and dumps. Here author suggested the use of these plastic bags pieces in a concrete as a plastic fiber to improve the properties of concrete. Use of plastic has a dual advantage cost of is low also it solves the problem of disposal of plastic up to some extent.

III. MATERIALS

Cement

Cement used for the test was ordinary Portland cement of 43 grade conforming to IS 8112- 1989. Various test was carried out, result of shown in Table.1.

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Table 1: Properties of Cement

Physical Properties	Test Results	Requirement as per IS 8112-1989
Standard Consistency	28.70%	
Initial Setting Time	43 min	minimum 30 min.
Final setting Time	240 min	maximum 600 min.
Specific gravity	3.21	
Compressive strength in N/mm ² after 7 days	30.5	
Compressive strength in N/mm ² after 14 days	37.5	
Compressive strength in N/mm ² after 28 days	47	

Fine Aggregate

Natural river sand was used as fine aggregate. The properties of sand were determined by conducting tests as per IS2386 (Part- I). results are shown in Table.2.

Table 2: Teston Fine Aggregate

Physical Properties	Test Results
Specific gravity	2.65
Fineness Modules	2.8
Water Absorption	0.65%
Free Moisture Content	0.20%

Coarse aggregate

Crushed granite stones obtained from local quarries were used as a coarse aggregate. The maximum size of coarse aggregate used was 20 mm. The properties of aggregate were determined by conducting test as per IS: 2386 (Part – III). The results are tabulated in Table.3.

Table 3: Properties of Coarse Aggregate

Physical Properties	Test Results
Specific gravity	2.6
Fineness Modules	2.98
Water Absorption	0.50%
Free Moisture Content	0.10%
Aggregate Impact Value %	12
Aggregate Crushing Value %	23

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Water

Portable water free from impurities and salt used for casting and curing the concrete blocks as per IS – 456-2000.

Plastic

Pieces Polyethylene bag are commonly used for the packaging and carrying goods are used in concrete

Concrete Mixes

Control mix concrete and modified concrete with varying percentages of pieces of waste plastic bags were presented in Table. All the mixes prepared are according to M 20 grade of concrete with w/c ratio 0.45.

IV. EXPERIMENT AND RESULTS

Compressive Strength Test :

Materials used: In this study, the concrete is composed of crushed sand 0–5mm and two types of gravel 3–8mm and 8–15 mm, supplied by the quarry (Mascara, Algeria), a cement type CEM II 32.5 from the cement Chlef (Algeria). Specific gravities for the sand and coarse aggregate were 2.62 and 2.65 respectively. The sand has a fineness modulus of 2.55. The physical properties of sand and the plastic waste are listed in Table 1, its particle size analysis of sand and the plastic waste. The recycled waste used is the plastic bag waste is obtained according to the following technological chain.

Table 5: Physical properties of sand and the plastic waste

	SAND	PLASTIC BAG WASTE
APPARENT DENSITY, a_d (g/cm ³)	1.45	0.53
Specific gravity, SG(g/cm ³)	2.56	0.87
Visual equivalent, VES (%)	8	-
Fineness modules, Fm	2.5	4.7

Formulation of Concrete's

The concrete composition was determined by Dreux Gorisse.

Method

The plastic bag waste was introduced by substitution of a variable percentage of sand such as: 5, 10, 15 and 40% and that, to better see their influence on the mechanical physical properties of the concrete. The different composition of concrete studied and their notations are presented in Table.6.

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Table 6: Mix proportions of the concrete's (kg/m³)

Materials (Kg)	Reference concrete (RC)	Concrete with plastic bag waste			
		CPW10	CPW20	CPW30	CPW40
		1.45	0.53	1.45	0.53
Cement	400	400	400	400	400
Water	190	190	190	190	190
Sand	467	420.3	373.6	326	280.2
PBW	0	16.25	32.5	48.75	65
Gravel 3/8	276	1.45	0.53	1.45	0.53
Gravel 8/15	1064	1064	1064	1064	1064

Preparation of specimens

After mixing concrete, the molds are met in three phases. For each phase, a vibration of the mould was carried out using a mobile stripe for 30s. For each series, three rectangle specimens (10x10x10 mm) were prepared by using the same composition. After demolding, the specimens were deposited in a water vat for 7 days

Experiment:

Compressive strength test was carried out on 150 mm X 150 mm X 150 mm specimen for that three cubes were prepared for each mix. Strength of each cube was evaluated after 7, 14 and 28 days respectively. Test was carried out as per IS 14858:2000. Result of compressive strength test was presented in Table.4.

Table 4: Compressive Strength Test Result N/Mm³

Mix Design			
Percentage of Plastic	5%	10%	15%
7 days	19.12%	14.75%	20.75
14 days	20.13%	24.87%	24.26
28 days	21.85%	27.81%	28.01

V. RESULT AND DISCUSSION

Compressive Strength

The 7, 14 and 28 days compressive strength result were presented in Table.4. The compressive strength of concrete goes on increasing with increase in percentage of plastic pieces. This increase in strength is may be due increase in bonding due introduction of plastic pieces.

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VI. CONCLUSION

Based on the Experimental result following points are summarized with regard to effect of plastic on the properties of concrete:

- Compressive strength of concrete is affected by addition of plastic pieces and it goes on increasing as the percentage of plastic increases addition of plastic in concrete causes about 20% increase in strength after 28 days curing.
- The splitting tensile strength observation shows the improvement of compressive strength of concrete. Up to 6.16 % of plastic improvement of strength recorded after that addition of strength of concrete increase with addition of plastic.
- Thus, it is concluded that the use plastic can be possible to increase the compressive strength of concrete.
- From the above discussion it is identified that the use of plastic can be possible to improve the properties of concrete which can act as a one of the plastic disposal method

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