STUDY OF USE OF PLASTIC WASTE IN 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.

Index Terms - Plastic, Waste, Cement, Concrete, Strength.

I. INTRODUCTION

The plastic is one of the recent engineering materials which have appeared in the market all over the world. Plastics were used in bath and sink units, corrugated and plain sheets, floor tiles, joint less flooring, paints and varnishes and wall tiles. 0ther than these, domestically plastics were used in various forms as carry bags, bottles, cans and also in various medical utilities. There has been a steep rise in the production of plastics from a mere 30 million kN in 1955, it has touched 1000 million kN at present. It is estimated that on an average 25% of the total plastic production in the world is used by the building industry. The per capita consumption of plastics in the developed countries ranges from 500 to 1000 N while in India it is only about 2 N. There is however now increase in awareness regarding the utilization of plastic as a useful building material in India. Plastics are normally stable and not biodegradable. So, their disposal poses problems. Research works are going on in making use of plastics wastes effectively as additives in bitumen mixes for the road pavements. Re-engineered plastics are used for solving solid waste management problems to a great extent. This study attempts to give a contribution to the effective use of waste plastics in concrete in order to prevent the ecological and environmental strains caused by them, also to limit the high amount of environmental degradation

Plastic is made of polymers.

Polymers have a number of vital properties, which exploited alone or together, make a significant and expanding contribution to constructional needs.

i. Durable And Corrosion Resistant
ii. Good Insulation For Cold, Heat And Sound Saving Energy.
iii. It Is Economical And Has A Longer Life.
iv. Maintenance Free(Such As Painting Is Minimized)
v. Hygienic And Clean
vi. Ease Of Processing/Installation
vii. Lightweight

Properties of different types of plastics

The easiest way for a consumer to identify the type of plastic used in a product is to find the resin identification code (also known as the material container code), is usually moulded, formed or imprinted in or close to the centre on the bottom of the container. This system of coding was developed in 1988 by The Society of the Plastics Industry (SPI), which is the Washington, D.C.-based trade association representing the US. Plastic industry. The intent was to provide plastic recyclers-which urged the industry to develop such a system with a consistent national system to facilitate recycling of post-consumer plastics through the normal channels for collecting recyclable materials from household waste.

The coding system is voluntary for plastic manufacturers but the use has become relatively standard on plastic products sold in the US. And internationally. In Canada, the system is in use and is endorsed by the Canadian Plastics Industry Association (CPIA), which provides details on the system through its Environment, Health & strategic unit and its Environment and Plastics Industry Council (EPIC)). The purpose of the coding system is to make it easier for plastics to be recycled, but the codes also provide consumers with a simple, handy technique for identifying the type of plastic resin used the make a particular product. In accordance with SPI guidelines, the code is deliberately placed in an inconspicuous location on the product because the industry intent is not to influence the consumer's buying decision, just to facilitate recycling of the product.

Table of common plastic resins and their characteristics organized according to the Society of the Plastics Industry (SPI) resin identification (or material container) code.

MAJOR TYPES OF PLASTICS BY S.P.I. CODES

SPI CODE	TYPE OF RESIN	EXAMPLE PRODUCTS	% OF PLASTIC
1	PET -Polyethylene terephthalate	Soft drink bottles, medicine containers	0.5%
2	HDPE- High-density polyethylene	Milk and water bottles, detergent bottles, toys	21%
3	PVC - Polyvinyl Chloride	Pipe, meat wrap, cooking oil bottles	6.5%
4	LDPE - Low-density polyethylene	Wrapping films, grocery bags	27%
5	PP-Polypropylene	Syrup bottles, yogurt tubs, diapers	16%
6	PS- Polystyrene	Coffee cups, "clamshells"	16%
7	Other		8.5%

II. Literature Review

Youcef Ghernouti, Bahia Rabehi, Brahim Safi and Rabah Chaid.

Research Unit: Materials, Processes and Environment, University M'Hamed Bougara of Boumerdes. Algeria.

In this the bulk density has decreased considerably for all concrete's with the content of replacement of sand by plastic waste that also becomes than lighter with 40% of plastic waste. Being given that the concrete must have good workability, fluidity is significantly improved by the presence of this waste. A reduction in the mechanical resistance according to the increase in percentage of plastic bag waste, which remains always close to the reference concrete, when we recorded a fall of compressive strength at 28 days about 10 and 24 % or the concrete's containing 10 and 20 % of waste respectively.

Finally, PBW aggregates can be used successfully to replace conventional aggregates in concrete without any long term detrimental effects and with acceptable strength development properties.

Raghat atul "Use of Plastic in Concrete to Improve Its Properties"

On his research Compressive strength of concrete is affected by the addition of plastic pieces and it goes on decreasing as the percentage of plastic increases the addition of l % of plastic in concrete causes about 20% reduction in strength after 28 days curing. The splitting tensile strength observation shows the improvement of the tensile strength of concrete. Up to 0.8 % of plastic improvement of strength recorded after that addition of strength of concrete decreases with the addition of plastic. Thus it is concluded that the use plastic can be possible to increase the tensile 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 one of the plastic disposal method.

Preen Mathew Shibi Varghese

A pilot study was conducted to determine the suitability of PCA for structural concrete. A percentage replacement of 22% NCA with PCA was found to be of superior concrete compressive strength. With regard to its tensile behavior, the bonding strength of PCA with matrix needs more attention since PCA concrete has shown a substantial reduction in split tensile strength and elastic modulus.

III. Material And Methods

a) **Cement :**

Cement used is opc 53 grade

b) **Fine aggregates:**

Locally available Wainganga river sand with specific gravity 2.65, water absorption 2% & fineness modulus 2.92 conforming to IS: 383-1970

c) **Coarse aggregate :**

(A) 20 mm: 60%
(B) 10 mm: 40 %

d) **Plastic waste**

The plastic waste used as aggregate was collected from a plastic recycling plant. The plant mainly recycles post-consumer PET bottles collected as compressed bales that come from urban and industrial collection sites. The bales of PET-waste mostly consist of dirty PET-bottles, which are usually contaminated with other materials and with some non-PET containers such as PVC, HDPE and poly propylene, bottles.

In this plastic waste treatment plant, several steps are adopted to recycle waste plastic. The coarse flakes and fine fractions were obtained after mechanical grinding of PET wastes followed by cleaning and separation by physic-chemical methods. The plastic pellet is produced from plastic flakes. This material consists of predefined and even-sized PET-grains, free of contamination at the microscopic level.

e) Water

Calculation For Quantity Of Material Used

1)**For cube** of size 15*15*15 cm of ratio 1:1.5:3

Volume of one cube	:-	3375 cm(3.375*$10^{-3}m^3$)
Density	:-	81N
Weight of cube	:-	8,256 kg
Cement required	:-	1.50 kg
Sand required	:-	2.25 kg
Aggregate required	:-	4.5kg
Total weight	:-	8.25kg

2) **For beam** of size 15*15*70 cm of ratio 1:1.5:3

Volume of beam	:-	15750cm(15.750*$10^{-3}m^3$)
Density of beam	:-	378 N
Weight of beam	:-	38.53 kg
Cement required	:-	7.00 kg
Sand required	:-	10.50 kg
Aggregate required	:-	21 kg
Total	:-	38.53 kg

3) **Plastic waste**

We take a 10% & 15% of cement.

4) **Water required**

W/c ratio =0.4

Water required = 0.4* cement required.

Calculation Of Stresses

Split-Tensile Strength of Concrete

The measured splitting tensile strength fct, of the specimen shall be calculated using the following formula:

$$f_{ct} = \frac{2P}{\pi LD}$$

Where,

P is the compressive load on the cylinder,(Failure load)

L is the length of the cylinder

D is its diameter.

Compressive strength of Concrete

$$f_f = \frac{P}{d^2}$$

Where,

P is the compressive load on the cube,

d is the side of the cube

Flexural strength Of Concrete

If a > 20cm,

$$f_b = \frac{PL}{bd^2}$$

But If 17 cm < a< 20 cm, then

$$fb = \frac{3Pa}{b\,d^2}$$

Where,

P is the compressive load on the beam

a is the distance between line of fracture and nearer support.

b is the measured width of specimen.

d is the measured depth at point of failure

L is the length of Span support

IV. Test

Test conducted on project work are

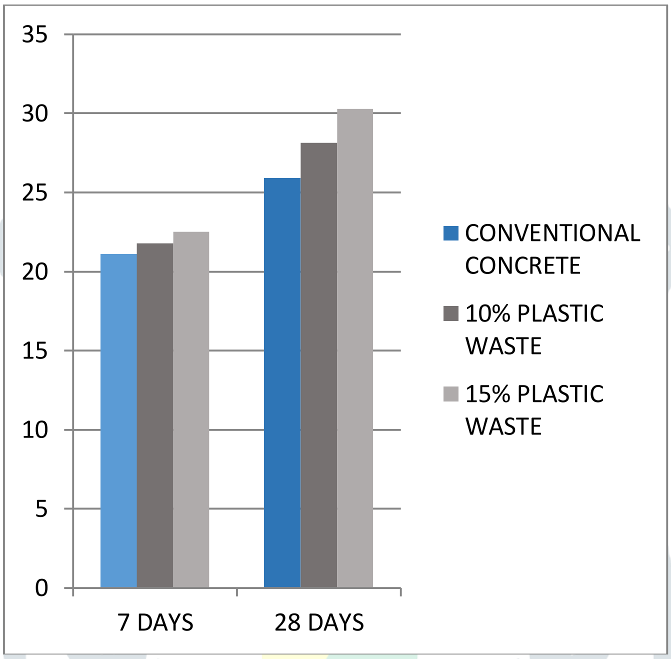
1. Compressive strength test
2. Flexural strength test.

IV. Results And Discussion

1. Compressive test on cube results with different % of plastic waste

Compressive strength test on cube

DAYS	CC (N/mm²)	10%PW (N/mm²)	15%PW (N/mm²)
7	21.11	21.78	24
28	25.93	28.15	30.3

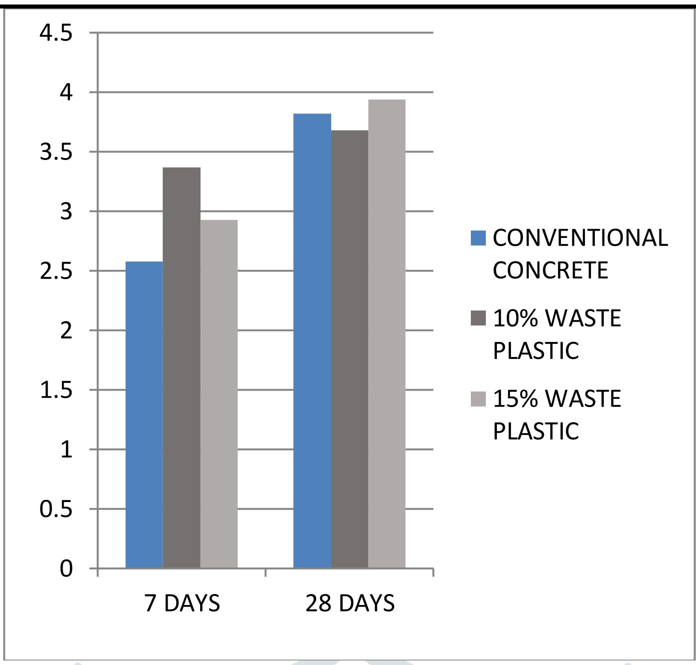


Comparative Compressive Strength Graph

2. Flexural strength test on beam with different % of plastic waste.

Flexural strength test on beam

DAYS	CC (N/mm²)	10% PW (N/mm²)	15% PW (N/mm²)
7	2.58	3.37	2.93
28	3.82	3.68	3.94



Comparative Flexural Strength Graph

V. CONCLUSIONS

A reduction in bleeding is observed by the addition of plastic waste in the concrete mixes. The percentage increase of compressive strength of various grades of plastic waste concrete mixes compared with ordinary concrete are:

For 7 Days
For 10% PW= 4%
For 15% PW= 14%
For 28 Days
For 10% PW= 8%
For 15% PW= 17%

The percentage increase of flexural strength of various grades of glass fibre concrete mixes compared with Ordinary concrete observed are

For 7 Days
For 10% PW= 30%
For 15% PW= 14%
For 28 Days
For 10% PW= 4%
For 15% PW= 4%

The Experimental results show that with the addition of plastic waste in varying percentages, there is a significant increase in Compressive strength and Flexural Strength of the conventional Concrete. Comparative analysis of Strength of Conventional concrete to plastic waste concrete is made and has been tabulated along with graphs.

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