An Experimental Investigation on Green Concrete

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ABSTRACT

Day to day plastic waste management is becoming the major environmental concerns in our India. The study covers the use of recycle plastic and ceramic waste as replacement of course aggregate in concrete. The main aim of this project is to investigate the behaviour of artificial aggregate in concrete. Globally 3500 million tone of plastic waste is produced in environment and 200 million tone of ceramic waste is produced annually in environment. As there is a demand for natural course aggregate as it is used as a conventional construction material. Hence to rectify this demand and to reduce the waste production. Plastic aggregates can be produced and can be replace in concrete in construction M20 concrete mix is used in replacement of 30%, 60%, 90% of artificial aggregate in concrete.

1. Introduction

Waste management is one of the major environmental concerns in our India. Many researches have been extended to study new kinds of wastes management. For solving the disposal of large amount of recycled plastic material, reuse of plastic in concrete industry is considered as the most feasible solution. The addition of wastes, apart from the environmental benefits, also produces good effects on the properties of final products. One of the new waste materials used in the concrete industry is recycled plastic.

Recycled plastic can be used as coarse aggregate in concrete. However, it is important to underline that re-using of wastes is not yet economically advantageous, due to the high costs of transport and its effect on the total costs of production. Moreover, it is important not to neglect other costs, directly referable to the kind of wastes, due, in particular, to the need of measuring gas emission, during firing, and the presence, of toxic and polluting elements. Plastics are durable and degrade very slowly; the molecular bonds that make plastic so durable make it equally resistant to natural processes of degradation. This not only affected our environment negatively but contributed to the degeneration of our natural aesthetics. This is the main reason we choose HDPE, to form as coarse aggregates in concrete.

In recent constructions, the consumption of ceramic materials is increasing day by day in the form of tiles, sanitary fittings, electrical insulators etc. But a large quantity of ceramic materials changes into wastage during processing, transporting and fixing due to its brittle nature. Therefore, using these wastes in concrete production could be an effective measure in maintaining the environment and improving the properties of concrete. Hence, the crushed waste ceramic

tiles were used in concrete as a replacement for natural coarse aggregates with 10%, 20%, 30%, 40% and 50% of substitution. After analyzing results, the optimum value of waste ceramic tile to be used within the

2. Experimental Investigation

Materials needed for concrete are Cement, plastics, ceramic waste, Fine Aggregate (sand), Coarse Aggregate (broken stone) and water.

2.1. Materials Used

ii) Aggregates

Dry and clean, locally available river sand conforming to grading zone-II as per IS: 383-1970 was used in concrete mixture. Its specific gravity was 2.65 with 1% absorption. Locally available coarse aggregate from quarry was used and they are rather rounded in shape with a maximum size of 20 mm size. The specific gravity and water absorption of coarse aggregate were 2.79 and 0.3% respectively.

(iii) Water

Water conforming to the requirements of IS: 456-2000 is found to be satisfactory for making concrete. It is generally stated that water fit for drinking is suitable for making concrete. For the present research, potable water free from salts is used for concrete mixing and curing.

concrete mix with a water/cement ratio of 0.5was determined as about 30%. The compressive and flexural strength of optimal concrete was found 5.43% and 32.2% higher than reference concrete respectively.

(i) Cement

Ordinary Portland Cement (OPC) of 53 grade confirming to IS 12269-1987 was used for this study. The specific gravity and Blaine specific surface area of PC were 3.12 and 2250 cm2/gm respectively. Metakaolin (MK) its specific gravity and Blaine specific surface area were 2.51 and 5300 cm2/g

2.2. Mix Proportion and Mix details

The mix proportions were made for a control mix of slump 80 mm for M20, grade of concrete for w/c ratio of 0.50 respectively by using IS-10262-2009 method of mix design. For concrete the coarse aggregate is fully replaced with artificial aggregate given in table 1.

Mix No	Mix Designation	W/C Ratio	Cement	FA	CA
M1	Conventional Concrete	0.5	383	568	1189
M2	Green Concrete	0.5	383	568	1189

Table 2: MIX PROPORTION

3. Test results

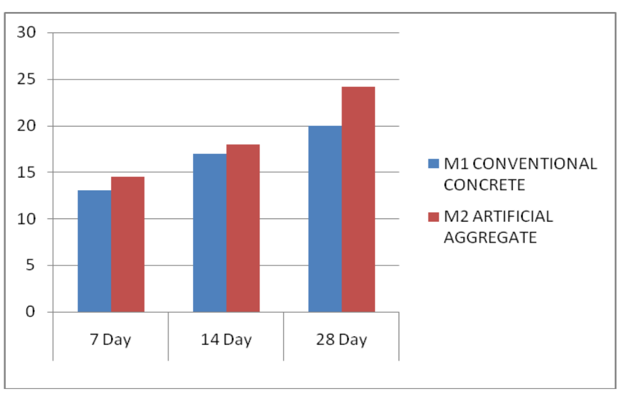
The test has conducted for fresh and hardened concrete. The test results are listed below.The properties of concrete were conducted for various mix proportion were tested. The 150 mm cubes (set of 3) each were cast for compressive (7, 14 and 28). All the cubes were de-mould after 24 hours time and put into the water tank for curing maintaining temperature of 27±2ºC as per IS requirements and tabulated below in table 3 and 4

Mix No	Mix Description	Slump (mm)	Comp factor (%)	Vee bee (sec)	Flow (%)
1	Conventional Concrete	85	0.9	8	40
2	Green Concrete	80	0.89	9.2	38

Table 2: Workability test

Mix No	Mix Designation	Compression Test		
		7 Day	14 Day	28 Day
M1	Conventional Concrete	13	17	20
M2	Green Concrete	14.5	18	24.18

Table 3 Compression test



Compression test result

4. Results and Discussion

This study indicates that the aggregate made with LDPE and ceramic waste are viable aggregates for the production of a light weight structure. Result obtained from varies test indicates that the Artificial aggregate concrete, there was an overall 22% reduction in self weight.

Conclusion

1. Plastics can be used to replace some of the aggregates in a concrete mixture. This contributes to reducing the unit weight of the concrete. This is useful in applications requiring nonbearing lightweight concrete, such as concrete panels used in facades.
2. The effect of water-cement ratio of strength development is not prominent in the case of plastic concrete. It is because of the fact that the plastic aggregates reduce the bond strength of concrete. Therefore, the failure of concrete occurs due to failure of bond between the cement paste and plastic aggregates.
3. Introduction of plastics in concrete tends to make concrete ductile, hence increasing the ability of concrete to significantly deform before failure. This characteristic makes the concrete useful in situations where it will be subjected to harsh weather such as expansion and contraction, or freeze and thaw.
4. The inclusion of recycled aggregates in the concrete of the buildings under investigation has been shown to be advantageous from an energy point of view. The use of [plastic aggregates helped in keeping the interior cooler, when the outside temperature is raised, as compared to the corresponding control concrete. Therefore we can made our final conclusion, this type of aggregate is very suitable to construct green house building structure

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