Utilization of Waste Plastic Granules in Concrete

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Abstract- *Disposal of waste plastics is a major problem in the present era, as the usage of plastics is growing day by day and it takes hundreds of years for plastic material to degrade. So effective ways to recycle & reuse of plastics are being formulated. So we found the alternative by melting these waste and preparing granules from it.*

In this work we are aiming to achieve alternatives for ingredients of concrete. we are going to use waste plastic granules as a replacement of fine and coarse aggregates. We are going to replace coarse aggregates in varying proportions like 10 %, 20 %, 30 %, 40% and 100% by waste plastic granules to produce concrete. And testing of the same shall be done in different trials and the results will be computed and compared with conventional concrete. The concrete will be casted in blocks of size 15 x 15 x 15 cm and further curing will be done. These blocks then will be taken for testing on 7th day, 14th day and 28th day for strength on compression testing machine. After the testing the sample blocks will be observed for physical parameters such as voids, uniform texture of the section and strength gain patterns on 7th day, 14th day, 28th day and accordingly changes will be made in the next trial mix.

Keywords- Cement, Concrete, Polypropylene Raffia, Waste Plastic Aggregates.

I. INTRODUCTION

Due to rapid increase of population in world, the amount of waste products such as waste plastic also increases rapidly .These waste plastic will remain in the environment for hundreds of years. The combined of these waste plastic in concrete may reduce the environmental problems up to certain extent The possibility of disposal of these wastages in mass concrete such as in heavy mass concreting in PCC in pavements where the strength of concrete is not a major criteria under consideration.

The word “plastic” means the substances which have plasticity and accordingly that it can be formed in soft state and used in solid state can be called plastic. The plastic can be separated into two types. The first type of plastic is thermosetting plastic and second is thermosetting. The thermo setting plastic cannot be melted by heating because the molecular chains are bonded firmly with meshed crosslink. These types of plastic are called polyurethane, silicone, epoxy resin, unsaturated polyester, melamine and phenolic. The second type is thermoplastic, which can be melted by heating and use for recycling in the plastic industry. These types of plastics are polypropylene, polyamide, polyethylene, polyoxymethylene. However at present these plastic wastages are disposed by either burning or burying, but the process is very costly. If the thermosetting plastics are reused, the cost of the process as well the pollution that is caused by the burning of plastic can be reduced. However to achieve this purpose, the thermosetting plastics are used in construction materials particularly concrete wall in construction.

II. MATERIAL USED

Materials	Primary Contribution/Desired Property
Portland Cement	Cementing material/durability
Micro Silica	Cementing material/durability/high strength
Fly-ash , GGBS	Filler material/Cementing material/high strength
Crush Sand	Fine aggregate to improve workability
Water	Hydration/Workability
PP Raffia	Replacement for course aggregate

1. Micro Silica - Silica fumes is added to Portland cement concrete to improve its properties, in particular its compressive strength, bond strength and abrasion resistance. These improvements stem from both in mechanical improvements resulting from addition of a very fine powder to the cement paste mix as well as from the pozzolonic reaction between the silica fumes and free calcium hydroxide in the paste. Addition in silica fume also reduces the permeability of concrete to chloride ions, protects the reinforcing steel of concrete from corrosion, especially in chloride – rich environment such as coastal regions and those of humid continental roadways and runways and salt water bridges.

With the addition of silica fumes, the slump loss with time is directly proportional to increase in the silica fume content due to introduction of large surface area in the concrete mix by its addition although the slump decreases the mix remains highly cohesive.

2. Fly Ash - Should confirm to IS: 3812-Part 1-2003, and should be finer than cement. Sources of fly ash should be chosen carefully. Processed fly-ash, in which, the fine fraction is developed by controlled grinding, is preferable.Fly-ash was used as an alternative of cement to reduce water absorption and hence ultimately helps in reducing the water cement ratio. Owing to its pozzolonic properties, fly-ash is used as a replacement for some of the Portland cement content of concrete.

3. GGBS - Concrete made with GGBS cement sets more slowly than concrete made with ordinary Portland cement, depending on the amount of GGBS in the cementious material, but also continues to gain strength over longer period in production condition. This result in lower heat of hydration and lower temperature rise, and makes avoiding cold joints easier, but may also affect construction schedules where quick setting is required.

4. PP Raffia - This material is used as a replacement of coarse aggregate. Poly propylene Raffia is manufactured by melting cement bags and remoulding it. The specific gravity of PP Raffia is 1.19.After taking impact test, the impact factor was found to be 2.52%.They have a rough texture which helps them to bind with cement slurry

III. EXPERMINATAL INVESTIGATION

The study was limited up to compression testing for 45 cubes of M20 grade and were produced as per following quantities.

Cement = 270 Kg/m^3
Water = 147 Kg/m^3
Coarse Aggregate (10 mm) = 381 Kg/m^3
Coarse Aggregate (20 mm) = 650 Kg/m^3
Water – Cement Ratio = 0.55
Chemical Admixture = 0.0023 m^3

The 45 cubes were cast and allowed to cure for 7,14 and 28 days. The compressive strength test on CTM having capacity of 90 KN were performed on 9 cubes of 7 days curing and it was repeated for 14 days and 28 days curing respectively.

IV RESULTS AND DISCUSSIONS

Table 1: Compressive strength for 7 days curing

Cube no	Percentage Variation & Strength(MPa)				
	10%	20%	30%	40%	100%
1	17	17.55	15.55	14.53	16.66
2	16.99	18	16.88	15.66	13.63
3	17.56	18.23	17.77	15.55	13.52

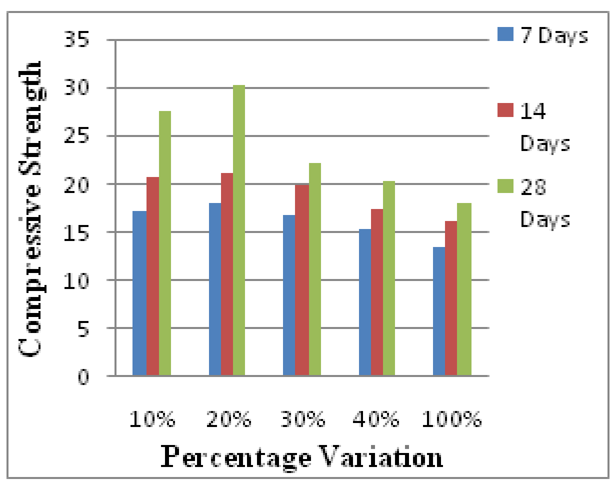
Table 2: Compressive strength for 14 days curing

Cube no	Percentage Variation& Strength(MPa)				
	10%	20%	30%	40%	100%
1	19.34	20.53	20	16.96	15
2	20.56	21.93	21.77	17.93	16.93
3	20.33	21.22	17.77	17.23	16.33

Table 3: Compressive strength for 28 days curing

Cube no	Percentage Variation& Strength(MPa)				
	10%	20%	30%	40%	100%
1	27.05	30.2	21.73	21.5	17.55
2	28.5	31.5	22	20.3	18
3	27.2	29.7	22.56	19.96	18.33

The above table 1 , 2 & 3 shows the compressive strength of concrete cubes by CTM.



Graph No. 1 Compressive strength Vs Percentage Variation

V. CONCLUSION

We have conducted many test trials in varying proportions, and their test results are concluded as below:-

1. The compressive strength was increased by around 8 % of the characteristic strength of M20 grade concrete after replacing 10 % of coarse aggregate by waste plastic aggregate.
2. The compressive strength was increased by around 18 % of the characteristic strength of M20 grade concrete after replacing 20 % of coarse aggregate by waste plastic aggregate.
3. The compressive strength was reduced by around 11.82 % of the characteristic strength of M20 grade concrete after replacing 30 % of coarse aggregate by waste plastic aggregate.
4. The compressive strength was reduced by around 19 % of the characteristic strength of M20 grade concrete after replacing 40 % of coarse aggregate by waste plastic aggregate.
5. The compressive strength was reduced by around 28 % of the characteristic strength of M20 grade concrete after replacing 100 % of coarse aggregate by waste plastic aggregate.
6. As the percentage of waste plastic aggregates were increasing there was some amount of decrease in their respective weights.
7. Hence, we found that optimum replacement of coarse aggregate up to 20 % by waste plastic aggregate can be done.

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