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Waste Plastic Textile Sludge Building Composite

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Abstract— *Waste plastic is the most neglected waste with less than 10% of it being recycled. Another waste viz. the textile sludge is used in concrete up to 25% by weight of cement or sand. Various researches are being conducted with waste plastic and textile sludge with cement as binder. In this paper it is projected to use the molten waste plastic and used cooking oil as binder and textile sludge as inert material along with natural red soil, fly ash and M- Sand. The composites thus obtained were cast in to cubes of 50sq cm. The cubes were tested for density, water absorption and compressive strength. The results showed the compressive strength near 10N/mm^2 and water absorption less than 5% for all composites.*

Keywords— *Waste Plastic, textile sludge, red soil, fly ash and M-Sand, Compressive strength.*

I. INTRODUCTION

Plastics are the most used materials after concrete and steel. But the recycling and reusing part is missing in plastics due its post use value. Due to this used and waste plastics are thrown out in to the environment or dumped in seas. With less than 10% recycling of waste plastic, we have miles to go in recycling the waste plastic. Every new method of recycling the waste plastic will definitely increase the reuse of waste plastics.

Textile sludge or Dye sludge is a material obtained after treatment of effluent from Textile or Dyeing Industry in Effluent treatment plants. It is considered hazardous due to chemical, dyes and heavy metals present in it. The textile sludge when used along with cement as binder reduces compressive strength of the resultant composite due to the presence of sulphates and chlorides. The effluent has a very high alkaline demand during treatment. The sludge contains heavy acidic properties which results in degradation of strength of cement based composites.

Hence this paper envisages a new method of recycling waste plastic such as Poly ethylene (PE), poly propylene(PP) and poly ethylene terephthalate(PET) as binder along with Textile sludge and other wastes such as fly ash and natural materials such as red soil and M-Sand as inert fillers in various combinations. Used cooking oil is used to increase the workability of the composite.

II. LITERATURE REVIEW

1. Sandplast was created using plastic as binder and sand as filler in various ratios. The ratio of 1:2 was found to be good in all tests. There was no disintegration of dissolution of sandplast in water. Showed compressive strength above 4 N/mm^2 strength

2. Plastics were used as inert fillers in Concrete paving blocks with mix, cement: quarry dust: sand = 1:1:2. Composite paving blocks with Less plastic (LP) in mix ratio of 1:1:2 and high plastic (HP) on a mix ratio of 1:0.5:1 were manufactured and tested. The study revealed Higher compressive strength for plastic aggregate composites. The authors suggest the usage of composite blocks in non traffic areas.

3. Interlocking paver blocks were manufactured using melted plastic binder with low density poly ethylene and high density polyethylene, ambient temperature and water curing were adopted. The interlocking paver blocks were found to show higher compressive strength than cement based blocks.

4. high tensile strength and brittle fracture behaviour was observed in the concrete containing natural aggregate and waste plastic as binder as compared to normal cement concrete in the studies done by A Horáková. et al.

5. construction material modified with plastic waste has high potential and It reduces the amount of plastic waste in to landfills or litter and It reduces the natural construction materials. Plastic waste has wide variety of uses such as a binder, aggregate, fine aggregate, modifier or substitute of cement and sand in concrete and also for making bricks, tiles, concrete and roads are reviewed in the review done by Lamba et al.

6. Pervious pavement blocks were made using waste plastic as binding material instead of cement. High Density Polyethylene (HDPE) was used in plastic based pervious pavement blocks. Aggregate was heated up to 190^{o}C., recycled HDPE plastic chips is mixed with it. The maximum compressive strength was 4.98 Mpa and Voids were 14% in the research by Mahendra et al.

7. Concrete mixes were made with waste plastic flakes partially replacing sand in varying percentages by volume. Waste plastic mix concrete with and without superplasticizer was tested at room temperature. Beams were made to study the flexural strength characteristics. Reduction in workability and compressive strength was observed.

8. Plastic characteristics, mix proportion design and concrete properties are reviewed. Fresh and hardened concrete properties, durability performance and thermal conductivity were also reviewed. The increase in insulation properties of concrete with plastic is also done.

III. RESEARCH METHODOLOGY

Three types of waste plastics viz. Poly ethylene, Poly propylene and Poly Ethylene Terephthalates were used as binders and Used oil as workability enhancer. Textile sludge, red soil, fly ash, M-sand were used as inert fillers. The plastic and used oil were heated using stove and container to maximum temperature of 200^{O}c and mixed to get uniform molten binder. The inert fillers were added to the molten binder and mixed thoroughly continuing the heating process. When uniform mix is obtained, it is cast into moulds of 50sqcm and allowed to cool

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in ambient conditions to get blocks. The blocks were tested for weight, water absorption and compressive strength.

A. Mixes

MIX	Waste plastic			Workability	Inert fillers			
	PP gms	PE gms	PET gms	UO gms	TS gms	M-Sand gms	RedSoil gms	Fly ASH gms
PPPEUOTS 1	100	100	--	200	400	--	--	--
PPPEUOTS 2	100	100	--	100	200	--	--	--
PPPEUOTS 3	150	150	--	100	200	--	--	--
PPPEUOTS 4	200	200	--	100	200	--	--	--
PPPEUOTS 5	200	200	--	200	200	--	--	--
PPPEUOTS 6	200	200	--	200	250	--	--	--
PPPEUORTS 7	200	200	--	200	100	--	100	--
PPPEUOR 8	200	200	--	200	--	--	200	--
PPPEUOFM 9	200	100	--	200	200	200	--	--
PPPEUOFTS 10	200	200	--	200	100	--	--	100
PPPETUOTS 11	200	--	170	170	200	--	--	--

Fig. 1. Water absorption in percentage.

B. Precautions During manufacturing

1. During heating and melting of waste plastic and oil, care should be taken to avoid spilling of oil or molten plastic as the melting temperature of all the plastics is above 150ºC.
2. Heat resistant gloves are must while handling the container and steel rods.
3. While adding textile sludge to molten waste plastic, fumes emanate due to the presence of volatile materials in the sludge. This may create obnoxious environment around the manufacturing place. Hence proper ventilation is must during manufacturing.
4. Suitable air masks can be used.

IV. RESULTS

Mix	Compressive strength	Water absorption	Density
PPPEUOTS 1	11.5	4.25	1.03
PPPEUOTS 2	24.02	5.7	1.02
PPPEUOTS 3	20.02	5.0	0.88
PPPEUOTS 4	9.00	2.7	1.05
PPPEUOTS 5	10.00	4.3	1.01
PPPEUOTS 6	10.00	3.6	1.00
PPPEUORTS 7	8.00	4.7	1.10
PPPEUOR 8	9.00	2.1	1.02
PPPEUOFM 9	10.00	4.2	1.05
PPPEUOFTS 10	8.00	2.8	1.05
PPPETUOTS 11	9.00	10.3	1.00

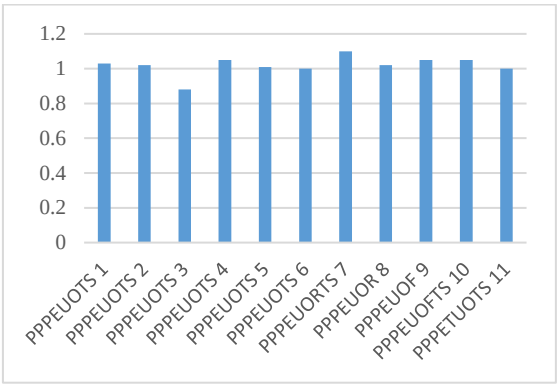

Fig. 2. Density in Gms/cc.

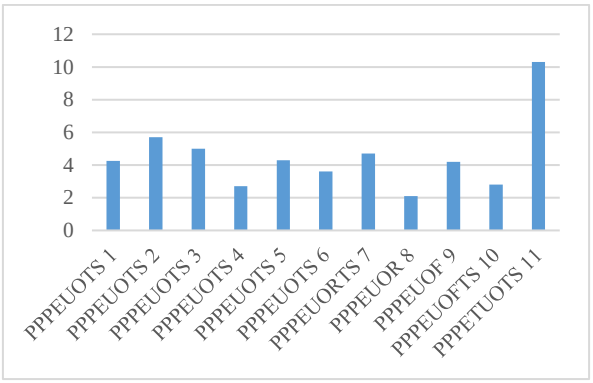

Fig. 3. Water absorption in percentage.

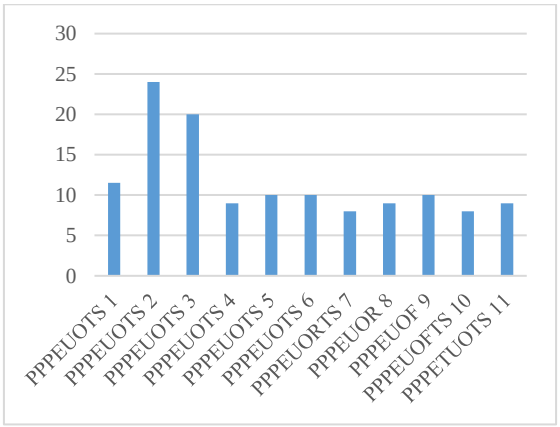

Fig. 4. Compressive strength in MPa.

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V. DISCUSSION

1. It was found that the all the composites showed density around 1 gms/cc
2. Maximum water absorption was found to be in PPPETUOTS11 lowest water absorption was found in PPPEUOR8 and PPPEUOTS4
3. Maximum compressive strength was in PPPEUOTS2 and 3 with 24 N/mm^2 and 20 N/mm^2.
4. All other mixes showed compressive strength greater 8 N/mm^2.
5. All the composites show water absorption less than 11%.

VI. CONCLUSION

Utilization of waste plastic and textile sludge along with used cooking oil to make composite cubes has high environmental advantages. Hence these varieties of composites can be effectively used for construction blocks such as bricks, damp proof course, hollow blocks, paver block, etc. where fire resistance is not a factor as these composites mainly use cooking oil and waste plastic as main ingredient.

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