

Reuse of Plastic Waste as Replacement of Sand in Concrete

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ABSTRACT: In the present scenario the construction cost as scarcity of sand is increasing day by day in order to counteract this problem, sand is partially replace by plastic waste material. Plastic waste is recycled for the production of new material which can be used as alternative component in concrete and is on of the best solution for disposing of plastic waste. Also this techniques proves to be highly cost effective then conventional method.

KEYWORDS: Highly cost effective, Recycling from Polyethylene Terephthalate or Polypropylene waste

I. INTRODUCTION

Due to rapid industrialization & urbanization in the Country, lots of infrastructure developments are taking place. This process has in turn led questions to mankind to solve the problems generated by this growth. The problems defined are acute shortage of constructional materials, increased dumping of waste products. Hence in order to overcome the above said problems waste products should be employed as construction material. Fine aggregates used in cement concrete is replaced by fine crushed plastics in known percentages and the optimum percentage at which higher strength is obtained is being calculated. Because plastic is widely available and not biodegradable, it is a material of choice to include.

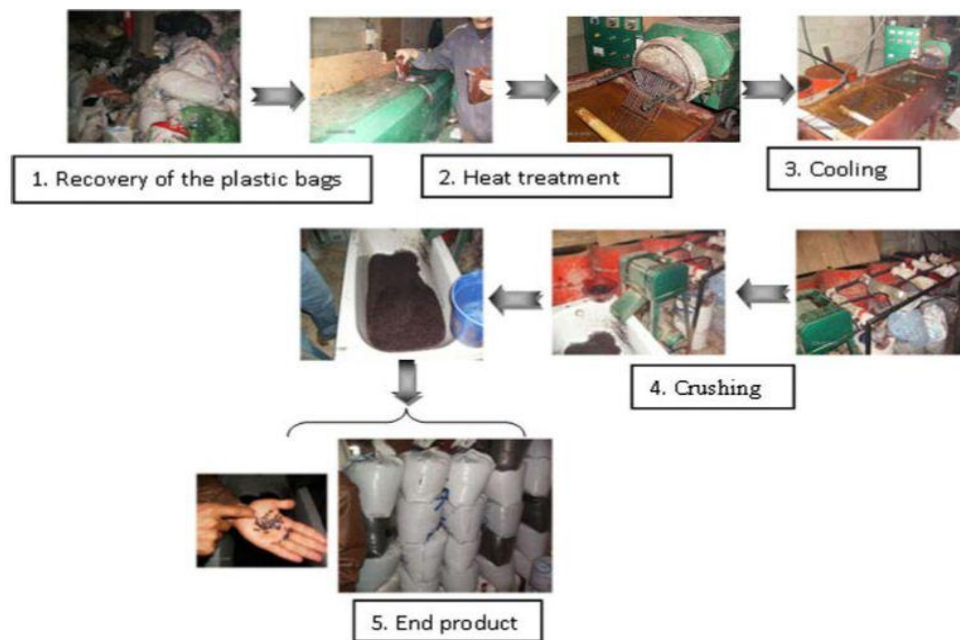
Generation of plastic waste is one of the fastest growing areas. Every year more than 500 billion plastic bags are used (nearly one million bag per minute). Hundreds of thousands of sea turtles, whales and other marine mammals die every year from eating discarded plastic bag for mistaken food. On land 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.

Disposal of plastics waste in an environment is considered to be a big problem due to its very low biodegradability and presence in large quantities. In recent time use of such, Industrial wastes from polypropylene (PP) and polyethylene terephthalate (PET) were studied as alternative replacements of a part of the conventional aggregates of concrete. If plastic wastes can be mixed with the concrete mass in some quantity or in some form, without affecting the fundamental and other properties or slight negotiation in strength of concrete. Due to which we can consume large quantities of plastic waste by mixing it in the concrete masses additive.

Industrial wastes from polypropylene(PP) and polyethylene terephthalate (PET) were studied as alternative replacement of a part of a conventional fine sand of concrete. Four replacement levels, 20%, 40% & 60% by volume of aggregates were used for the preparation of the concretes. The results of this research suggested that PP and PET can be used in concrete containing 40% by volume of PP and PET as fine sand replacement give satisfactory result. The results suggest that temperature up to 170⁰ C produce little damage to concrete that contains PET or PP material but it was expected, concrete to 250⁰ c was seriously damaged.

II. PROCESS OF GENERATION OF WASTE PLASTIC

For a getting a final product of plastic waste material first of all to collect a the plastic waste from the surrounding industrial and non industrial areas. From this collection to separate the waste material accordingly their content, material, hardness etc. then this material are grinding in the grinding machine then this grinded material are heated in high temperature in heater. After heating to form a small wire of long length then this wire cooled in a water and after cooling this wire are cutting in a small granular pieces to form a final product of waste plastic material.



Process Of Generation Of Waste Plastic Material.

III. RELATED WORK

In this experimental investigation we replace the natural river sand by using the plastic waste which is recycling from PET or PP waste. Partial replacement of sand by plastic waste material is done with M20 grade of concrete. Plastic waste where used to replace 20%, 40% & 60% of natural river sand in the concrete mixes and tested after 28 days for compressive strength, tensile strength, flexural strength and modified density of concrete.

The experiment revealed that the partial replacement of plastic waste material can be done to a limit of 20% to 40% for the satisfactory properties of concrete which is acceptable limit for the constructional purpose in the civil industry.

IV. QUANTITY OF MATERIALS

Total Quantity Of Materials Required For One Set Of Cube, Cylinder And Beam For Each Percentage. For M20 Grade (1:1.5:3) Of Concrete.

Sr. No	Replacement Of plastic Waste (%)	Specimen To be casting	Cement (Kg)	Sand (Kg)	Aggregate 3/4"(Kg)	Aggregate 1/2"(Kg)	Plastic Waste(Kg)
1	0	3cubes,3cylinder & 3 beams	36	54	54	54	0
2	20	3cubes,3cylinder & 3 beams	36	43.20	54	54	4.066
3	40	3cubes,3cylinder & 3 beams	36	32.40	54	54	8.132
4	60	3cubes,3cylinder & 3 beams	36	21.60	54	54	12.198

V. EXPERIMENTAL RESULT

5.1.Results Of Test Carried On Plastic Waste Material

Test	Fineness modulus	Specific Gravity	Water absorption
Result	2.74	0.93	0 %

5.2. Result of test On Hardened Concrete

5.2.1. Density Of Modified Concrete

Replacement of waste plastic %	No.	Density Of Concrete(Kg/m ³)	Avg.Density(Kg/m ³)
0	1	2605.62	2574.80
	2	2613.62	
	3	2505.18	
20	1	2546.37	2522.07
	2	2556.74	
	3	2463.11	
40	1	2483.25	2467.92
	2	2513.18	
	3	2413.33	
60	1	2408.00	2354.43
	2	2328.80	
	3	2326.51	

5.2.2. Compressive Strength Of Concrete

Compressive strength of concrete cube specimen tested after 28 days of curing

Replacement of waste plastic %	No.	Load At Failure (KN)	Strength (N/mm ²)	Avg.strength (N/mm ²)
0	1	633.7	28.10	26.47
	2	608.4	27.0	
	3	547.4	24.3	
20	1	781.9	34.7	34.53
	2	767.0	34.0	
	3	787.2	34.9	
40	1	666.6	29.6	32.3
	2	818.7	36.3	
	3	698.2	31.0	
60	1	636.3	28.2	25.83
	2	583.2	25.9	
	3	527.9	23.4	

5.2.3. Split Tensile Strength Of Concrete

Split tensile strength of concrete cylinder specimen tested after 28 days of curing

Replacement of waste plastic %	No.	Load At Failure(KN)	Strength(N/mm ²)	Avg.strength(N/mm ²)
0	1	215.2	12.1	11.133
	2	183.7	10.3	
	3	195.9	11.0	
20	1	193.6	10.9	10.87
	2	187.4	10.6	
	3	197.9	11.1	
40	1	162.1	9.1	8.833
	2	162.7	9.2	
	3	146.1	8.2	
60	1	129.7	7.3	7.233
	2	124.5	7.0	
	3	132.3	7.4	

5.2.4. Flexural Strength Of Concrete

Flexural strength of concrete beam specimen tested after 28 days of curing

Replacement of waste plastic %	No.	Max. Load (KN)	Strength At 28 Days (N/mm ²)	Avg. strength (N/mm ²)
0	1	24	43.49	42.88
	2	24	43.49	
	3	23	41.68	
20	1	23	41.68	45.303
	2	24	43.49	
	3	28	50.74	
40	1	26.5	48.023	45.998
	2	24	43.49	
	3	27	46.483	
60	1	22	39.868	40.547
	2	23.5	40.457	
	3	24	41.318	

VI. CONCLUSION

1. The fresh concrete mix using plastic waste material are gives the increase in workability as increase in % replacement of plastic waste material so from this by using plastic waste in concrete, the concrete mix should be more workable than conventional concrete mix.
2. The test result of this experimental study on density of concrete is reduction in density as increase in % replacement of plastic waste. due to this self weight (dead load) of the concrete structure is reduce. Therefore design of concrete structure becomes economical.
3. The concrete for M20 grade have a nominal compressive strength is 20 N/mm². Replacement of natural river sand by plastic waste material in 20% and 40% increase in the compressive strength of concrete up to acceptable limit.
4. With replacement of sand by plastic waste in concrete cylinder gives the split tensile strength of 20% should be same as traditional concrete without replacement.
5. Flexural strength of concrete with replacement of plastic waste gives the satisfactory result up to a 40%. When a replacement of plastic waste in concrete increases above 40% then the gradual reduction in flexural strength of beam is to be noted.
6. The use of waste plastic in concrete is relatively new development in the world of concrete technology and this research must prove that the replacement of plastic waste in concrete is possible as natural river sand.
7. "Reuse of plastic waste as replacement of sand in concrete" can be conveniently used as an alternative research to the convectional concrete in the construction industry.

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