International Journal of Multidisciplinary Research and Modern Education (IJMRME)
Impact Factor: 6.725, ISSN (Online): 2454 - 6119
(www.rdmodernresearch.org) Volume 3, Issue 1, 2017

PLASTIC MIX CONCRETE BY USING WASTE PLASTIC POWDER AND PLASTIC GRANULES WITH COMPRESSIVE STRENGTH

Dr. N. Venkatesh
Department of Civil Engineering, BIT, Hindupur, Andhra Pradesh

Cite This Article: Dr. N. Venkatesh, "Plastic Mix Concrete by Using Waste Plastic Powder and Plastic Granules With Compressive Strength", International Journal of Multidisciplinary Research and Modern Education, Volume 3, Issue 1, Page Number 40-44, 2017.

Abstract:

Plastic mix concrete is an eco friendly concrete which is more effective used in sanitation which can reduces the bacterial effects and increases the ground water level. One of the waste materials used in this concrete mix is 'Plastic'. The plastic materials used for concrete mix are waste plastic powder and plastic granules. The main aim of the study is to investigate the change in mechanical properties of concrete with addition of plastics in concrete. Usually, M20 concrete is used for most of the constructional works, hence in this project M20 concrete is taken and waste plastics is used as a modifier. Modifier was added in percentage such as 3%, 5%, 10%, 15% in order to replace the same amount of cement and fine aggregates. Tests were conducted on coarse aggregates, fine aggregates, cement and modifiers (waste plastics) to determine their physical properties. These tests were conducted at room temperature and these tests include performing slump, fresh density, dry density, compressive strength. Cubes were casted and tested for 7 & 28 day's strength.

Key Words: Plastic Granules, Compressive Strength, M20 Concrete, Organic Solid, PVC, Properties & Cubes

Introduction:

A plastic material is an organic solid, essentially a polymer or combination of polymers of high molecular mass. A polymer is a chain of several thousand of repeating molecular units of monomers. The monomers of plastic are either natural or synthetic organic compounds. The term resin is sometimes used as synonym of a commercial polymer. Plastics can be classified by chemical structure, i.e. by the main monomer of the polymer's backbone and side chains. The content of additives in plastic varies widely from less than 1% in PET bottles and up to 50-60% in hard PVC, striking often a balance between technical properties and economics, as some additives are considerably more expensive than the main polymers, Stabilizers (acids, oxidation, biodegradation, heat, UV, etc), Flame retardants, Plasticizer, Colorants, Antifogging and antistatic agents, Optical brighteners, fluorescent whitening agents, Impact modifiers, Lubricants, Nucleating agents.

Objectives:

- ✓ To determine the effect of the water-to-cementations-material ratio on compressive strength.
- ✓ To determine the effect of plastic replacement level on compressive strength.
- ✓ To determine the effect of curing on compressive strength.

Future Scope:

- ✓ The use of waste plastics in concrete is relatively a new development in the world of concrete technology and lot of research must go in before this material is actively used in concrete construction.
- ✓ The use of plastics in concrete lowered the strength of resultant concrete, therefore, the research must be oriented towards ternary systems that helps in overcoming this drawback of use of plastics in concrete.
- ✓ Estimation of the types, quantity and useful components present in the waste plastic materials in the city and surrounding areas.
- ✓ Methodology for collection and sorting out the useful components of the plastic waste.
- ✓ Carrying out further laboratory investigations, construction of some test tracks and field studies on the performance of concrete using the modified concrete.
- ✓ Working out relative economics of using the modified concrete mixes in road construction works, considering the improved performance and increased service life of the pavement.
- ✓ Preparation of specifications and standards for the construction industry.

Observation and Results:

Compressive Strength Test Results:

Compressive Strength = (Ultimate crushing load / area of loading) in N/mm^2

CS = $(880 \times 10^3 / 150 \times 150)$

= $39.11\ N/mm^2$

Compressive strength test results are as given in the following tables for various percentage of waste plastic.
Size of cubes: 150 mm x 150 mm x 150 mm

Compressive Strength of Concrete without Waste Plastic and Plastic Granules:

Table 1: Test Result of 7 Days compressive strength of concrete without waste plastic and plastic granules

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	7	559	24.84	24.58
2	B10	7	501	22.26	
3	B10	7	600	26.66	

Table 2: Test Result of 28 Days compressive strength of concrete without waste plastic and plastic granules

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	28	854	37.95	42.43
2	B10	28	968	43.02	
3	B10	28	1042	46.33	

Compressive Strength of Concrete with Percentage of Waste Plastic:

Table 3: Test Result of 7 Days compressive strength of concrete with 3% waste plastic

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	7	470	20.88	22.95
2	B10	7	530	23.55	
3	B10	7	550	24.44	

Table 4: Test Result of 28 Days compressive strength of concrete with 3% waste plastic

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	28	850	37.77	39.37
2	B10	28	920	40.88	
3	B10	28	890	39.55	

Table 5: Test Result of 7 Days compressive strength of concrete with 5% waste plastic

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	7	490	21.77	23.84
2	B10	7	550	24.44	
3	B10	7	570	25.33	

Table 6: Test Result of 28 Days compressive strength of concrete with 5% waste plastic

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	28	870	38.66	39.71
2	B10	28	951	42.66	
3	B10	28	860	38.22	

Table 7: Test Result of 7 Days compressive strength of concrete with 10% waste plastic

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	7	465	20.66	21.92
2	B10	7	515	22.88	
3	B10	7	500	22.22	

Table 8: Test Result of 28 Days compressive strength of concrete with 10% waste plastic

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	28	830	36.88	38.51
2	B10	28	910	40.44	
3	B10	28	860	38.22	

Table 9: Test Result of 7 Days compressive strength of concrete with 15% waste plastic

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	7	460	20.44	21.47
2	B10	7	500	22.24	
3	B10	7	490	21.77	

Table 10: Test Result of 28 Days compressive strength of concrete with 15% waste plastic

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	28	820	36.44	37.10
2	B10	28	890	39.55	
3	B10	28	795	35.33	

Compressive Strength of Concrete with Percentage of Plastic Granules:

Table 11: Test Result of 7 Days compressive strength of concrete with 3% plastic granules

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	7	460	20.44	21.49
2	B10	7	490	21.77	
3	B10	7	501	22.26	

Table 12: Test Result of 28 Days compressive strength of concrete 3% plastic granules

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	28	800	35.55	38.21
2	B10	28	920	40.88	
3	B10	28	860	38.22	

Table 13: Test Result of 7 Days compressive strength of concrete with 5% plastic granules

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	7	480	21.33	21.86
2	B10	7	495	22	
3	B10	7	501	22.26	

Table 14: Test Result of 28 Days compressive strength of concrete with 5% plastic granules

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	28	810	36	38.36
2	B10	28	930	41.33	
3	B10	28	850	37.77	

Table 15: Test Result of 7 Days compressive strength of concrete with 10% plastic granules

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	7	505	22.44	20.45
2	B10	7	450	20	
3	B10	7	430	19.11	

Table16: Test Result of 28 Days compressive strength of concrete with 10% plastic granules

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	28	815	36.22	36.73
2	B10	28	870	38.66	
3	B10	28	795	35.33	

Table 17: Test Result of 7 Days compressive strength of concrete with 15% plastic granules

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	7	501	22.26	20.01
2	B10	7	430	19.11	
3	B10	7	420	18.66	

Table 18: Test Result of 28 Days compressive strength of concrete with 15% plastic granules

S.No	Cube Id No	Age in Days	Load in KN	Compressive Strength (N/mm^2)	AVG Compressive Strength (N/mm^2)
1	B10	28	800	35.55	34.88
2	B10	28	765	34	
3	B10	28	790	35.11	

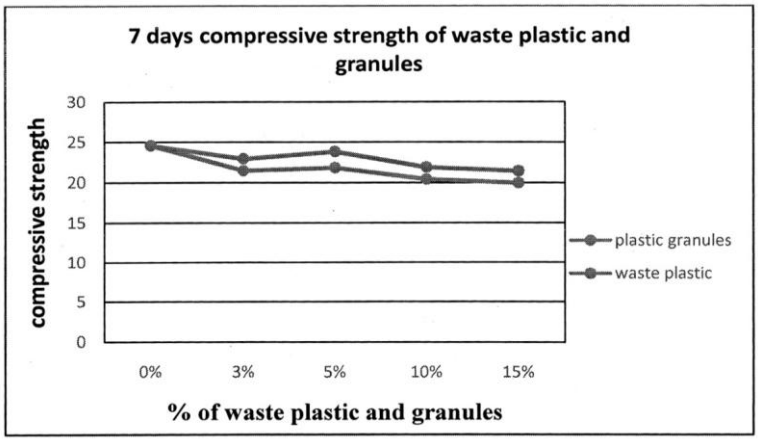

Figure 1: 7 days compressive strength of waste plastic and granules

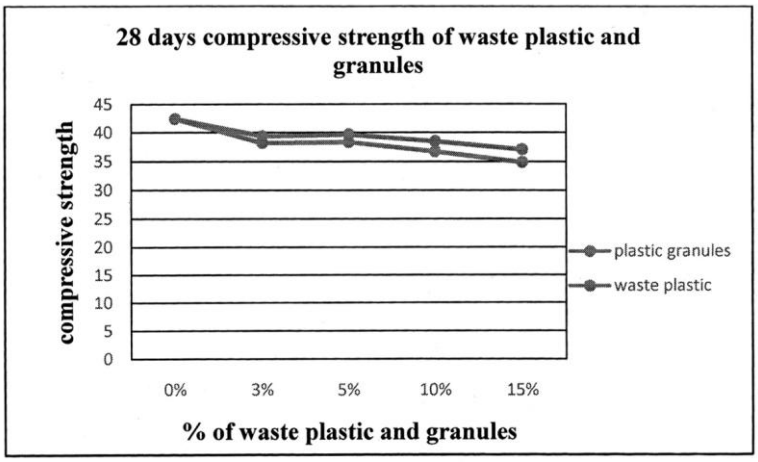

Figure 2: 28 days compressive strength of waste plastic and granules

Results & Discussion:

Comparison of compression strength obtained in the laboratory tests indicates that there is very little variation in strength with decrease in the percentage of waste plastic. The variation is not remarkable the percentage of increase for various percentage of waste plastic is as given below:

Table 19: Maximum Compressive strength results for 28 days

No. of Days	Strength increase for various percentage of waste plastic				
	0%	3%	5%	10%	15%
28	42.43	39.37	39.71	38.51	37.10

Table 20: Maximum Compressive strength results for 28 days

No. of Days Cured	Strength increase for various percentage of plastic granules				
	0%	3%	5%	10%	15%
28	42.43	38.21	38.36	36.73	34.88

Conclusion:

- ✓ By observing the slump values if the percentage of plastic increases, then the slump value decreases.
- ✓ By observing the test results, we can say that the compressive strength of plastic concrete has slightly decreased when compared to ordinary concrete.
- ✓ By comparing waste NYLON 06 & NYLON 09 granules compressive strength results, we can say that the compressive strength of waste Nylon is greater than Nylon granules.
- ✓ It also helps to avoid the general disposal technique of waste plastic like land filling and incineration.
- ✓ When this modifier used in the rigid pavements it can carry the more load then it can used in construction of small drainage works.

References:

1. "Concrete Technology" by M.S. Shetty, 2006 Edition
2. Iranian Polymer Journal, 12(4), 2003, 323-329.
3. http://irc.nrc-cnrc.gc.ca/pubs/cbd/cbd242_e.html
4. http://irc.nrc-cnrc.gc.ca/pubs/cbd/cbd241_e.html
5. http://en.wikipedia.org/wiki/Polymer_concrete
6. http://www.labyrinthproject.com/polymer.html

7. ACI Committee 226, “use of waste plastic in concrete”. ACI 226, 3R-87.
8. ACI Committee 232. (2003). “Use of waste plastic in Concrete”. ACI Manual of Concrete Practice 232.2R-03.
9. American Society for Testing and Materials. (1975). ASTM C 595. “Standard specification for blended hydraulic cements”. In annual book of ASTM standards, Part 13. ASTM, Philadelphia, PA, pp. 353.