ECO Friendly Concrete By Using Partial Replacement Of Cement By GGBS And Sand By Poly Propylene Plastic

Challa. Nithin Kumar Reddy, Jonnalagadda Rakesh

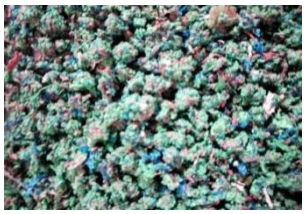
***Abstract*— The use of recycled materials is accepted in concrete industry since there are several possible developments in concrete industry. The present study is an effort to gain strength of concrete by replacing ground granulated blast furnace slag (GGBS) that which is obtained from the molten steel is used as supplementary material for ordinary cement and demolished poly propylene is used as supplementary material for fine aggregate at various replacing levels and evaluate the efficiencies and properties in hardened concrete.**

***Index Terms*— Ggbs, Poly Propylene, Compressive strength, split tensile strength**

I. INTRODUCTION

Ground Granulated Furnace Slag (GGBS) is by product obtained from the iron industry, The slag obtained is a mixture of silicon oxide (sio_2) of 40% and Calcium oxide (Cao) of 40% which is similar to the composition of ordinary Portland cement, By replacing GGBS in Portland cement it leads to reduction in carbon dioxide emission, so GGBS is treated as an eco-friendly construction material. The concrete with GGBS has a better impermeability of water characteristics as well as it also helps in resistance to sulphate attack in the structure, By using natural resources we can save natural resources this reduces the usage of cement in concrete, in recent days disposal of plastic is becoming a major problem and it is taking hundreds of years to decompose in the soil to solve this problem to some extent we can use the recycled plastic particles as a replacement material for aggregates in concrete mix so that the plastic waste can be disposed to some extent. This study is carried by replacing GGBS and poly propylene plastic at various percentages in concrete mix.

(a)GGBS Colour



(b) Poly Propylene plastic

Challa. Nithin Kumar Reddy, Assistant Professor, Chalapathi Institute Of Engineering And Technology Guntur, Andrapradesh, 9052371703

Jonnalagadda Rakesh, Assistant Professors, Chalapathi Institute Of Engineering And Technology Guntur, Andrapradesh, 9989291221

II. METHODOLOGY:

The main research of project is to utilize the blast furnace slag which is extracted from the iron industry which is known as GGBS, and also to use recycled plastic which is named as

poly propylene as partial replacement for fine aggregate. The research process is carried over by replacing the fine aggregate which is extracted from the river naturally with the recycled plastic particles which is passed from the 4.75mm sieve and the cement is replaced by GGBS. The plastic aggregate is replaced with 10% of fine aggregate and the GGBS is replaced for cement at various percentages such as 10%, 20%, 30%, 40% and 50% by keeping plastic aggregate 10% as constant for the same mix.

III. EXPERIMENTAL INVESTIGATION:

MATERIAL USED:

Materials used in the experiment are ordinary Portland cement of 43grade cement confirming to Is:8112-1989 is used and the specific gravity of cement is 3.15 and locally available sand is used as fine aggregate and coarse aggregate of 12.5mm size are used and also ground granulated furnace slag is used as replacement material for cement and poly propylene plastic particles which are passed from 4.75mm sieve are used as replacing material for the fine aggregate.

PROPERTIES OF GGBS

Test	**Unit**	**BS Requirement**	**GGBS-CRC**	**GGBS-SG**
Density	Kg/m^3	Not specified	2880	2910
Fineness (specific surface)	Cm^2/g	Not less than 2750	4490	4550
Standard consistence	%	Not specified	29	27.5
Initial setting time	Min	175	220	235
Soundness	mm	Not specified	0	0.5

PROPERTIES OF POLY PROPYLENE

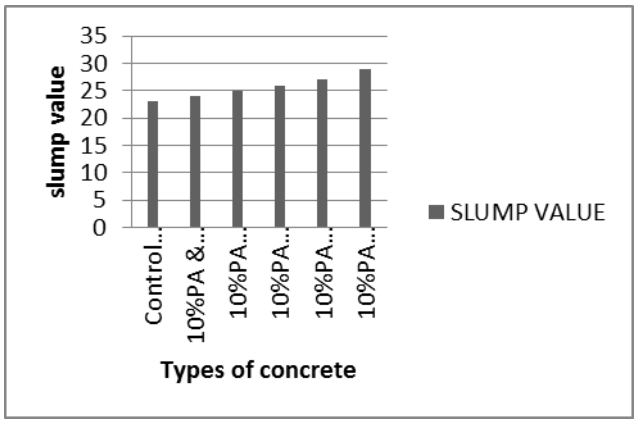
Properties	Polypropylene Plastic
Specific gravity	1.01
Absorption %	<0.2
Colour	White, green & dark
Shape	Angular
Crushing value	<2%
Impact value	<2%

The total experiment is carried for M_{30} grade of concrete with partial replacement of materials, Totally 72 cubes were casted of 150 mm *150 mm *150mm size, for testing of compressive strength and 7 cylinders were casted of 150 mm diameter and 300 mm height size were casted for testing of split tensile strength.

MIX PROPORTION DETAILS

In this Research M30 mix concrete is performed the mix is done by weight basis by adopting poly propylene of 10% in fine aggregate uniform for all mixes and GGBS of various proportions of 10%, 20%, 30%, 40% and 50%.

SLUMP VALUES



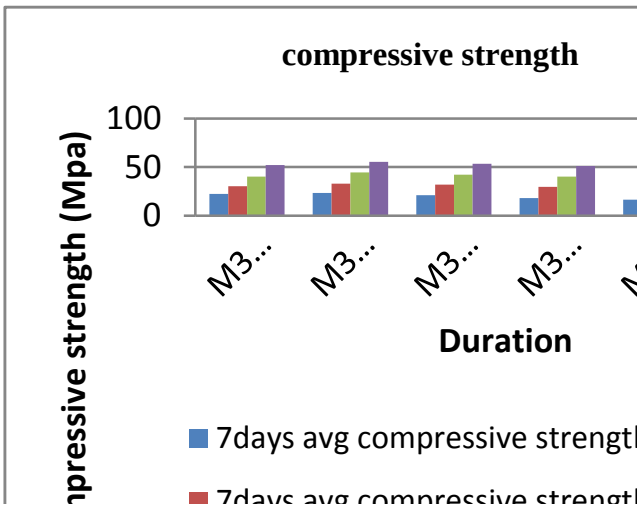
TYPE OF CONCRETE	SLUMP VALUE
Control concrete	23
10%PA & 10% GGBS	24
10%PA &20% GGBS	25
10%PA &30% GGBS	26
10%PA &40% GGBS	27
10%PA &50% GGBS	29

IV. TEST SPECIMEN AND RESULTS

Concrete cubes of 150 mm *150 mm *150mm size, cylinders of 150 mm diameter and 300 mm height were used as test specimens to determine the compressive strength split tensile test of concrete.The concrete is thoroughly mixed and compacted in to moulds and demould the moulds after 24 hours of casting and cured the specimens in water for 7,14,28,56 days.

Compressive Strength Results for M30grade Concrete With Various % Of Partial Replacement of GGBS &10% PLASTIC for 7,14,28,56 days

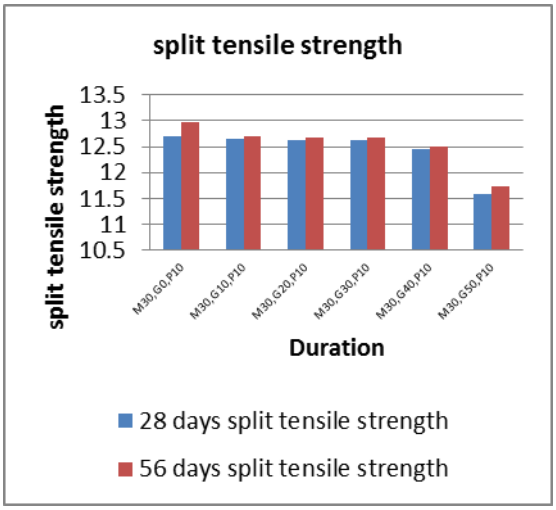
Mix No	W/C	% OF GGBS	7DaysAvg compressive strength(Mpa	14Days Avg compressive strength(Mpa	28Days Avg compressive strength(Mpa	56Days Avg compressive strength(Mpa
M30,G0,P10	0.44	0	22.56	30.2	40.2	52.1
M30,G10,P10	0.44	10	23.4	33.02	44.5	55.3
M30,G20,P10	0.44	20	21.2	32.1	42.3	53.4
M30,G30,P10	0.44	30	18.03	29.7	40.32	51.2
M30,G40,P10	0.44	40	16.3	27.7	38.06	50.4
M30,G50,P10	0.44	50	15.2	26.02	35.7	47.2



Split tensile Strength Results for M30grade Concrete with Various % Of Partial Replacement of GGBS &10% PLASTIC for 7,14,28,56 days

The indirect method of applying tension in the form of splitting is conducted to evaluate the combined effect of plastic waste & Ggbs on tensile properties of concrete. In this test, a concrete cylinder of size 150 mm diameters and 300 mm length is placed with its axis horizontal between the plates of the testing machine.

Mix No	W/C	% OF GGBS	28Days Avg split tensile strength(Mpa)	56Days Avg split tensile strength(Mpa
M30,G0,P10	0.44	0	12.69	12.98
M30,G10,P10	0.44	10	12.65	12.69
M30,G20,P10	0.44	20	12.62	12.67
M30,G30,P10	0.44	30	12.62	12.68
M30,G40,P10	0.44	40	12.45	12.51
M30,G50,P10	0.44	50	11.58	11.72



V. CONCLUSION:

Based on experiment that was conducted,the following conclusions can be drawn.

1. It is observed that plasto GGBS concrete is achieved an increase in strength gradually by increase in time.
2. By using the plastic waste the weight of cubes is reduced by 2 to 5%
3. From the experiment conducted I conclude that the use of plastic in concrete is the best option to dispose plastic to some extent.

REFERENCES

[1] **ACI Committee 233 (2000)**, Ground Granulated Blast-Furnace Slag as a Cementitious Constituent in Concrete, ACI 233R-95.

[2] **Domone, P. Illston, J. (2010)**, Construction materials, their nature and behavior, Spon Press, 4th Edition, New York, USA.

[3] **Gruyaert, E. (2011)**, Effect of blast-furnace slag as cement replacement on hydration, microstructure, strength and durability of concrete, Dissertation (monograph), Department of Structural Engineering, University of Ghent, Belgium.

[4] **Neville, A. M, (2003)**, Properties of concrete. Pearson Education Limited, Edinburgh.

[5] **NORDTEST (1999)**, Concrete, Mortar and Cement Based Repair Materials: Non Steady-State Migration Experiments, NT Build 492, NORDTEST, Espoo

[6] **Ramachandran, V.S. (1995)**, Concrete Admixtures Handbook – Properties, Science, and Technology, 2nd Edition, William Andrew Publishing, ISBN 0-8155-1373-9.

[7] **SIS, Swedish Standard Institute (2001), SS-EN 206**, Concrete – Part 1: Specifications, properties, production and conformity.

[8] **SIS, Swedish Standard Institute (2005)**, **SS 13 72 44**, Concrete testing - Hardened concrete - Scaling at freezing.

[9] **SIS, Swedish Standard Institute (2005), SS-EN 15167-1,** Ground granulated blast furnace slag for use in concrete, mortar and grout – Part 1: Definitions, specifications and conformity criteria, October 2006.

[10] **SIS, Swedish Standard Institute (2008), SS 13 70 03,** Concrete – Usage of EN 206-1 in Sweden, SIS.

[11] **Utgenannt, P. (2004)**, The influence of ageing on the salt-frost resistance of concrete, Ph.D. Thesis. Lund Institute of Technology. Division of Building Materials. ISBN 91-628-6000-3.

[12] **Madam Mohan Reddy, K, Ajitha .B, and Bhavani .R,** "Melt-Densified Post Consumer Recycled poly propylene Plastic Bags Used as Light Weight fine Aggregate in Concrete"," International Journal of Engineering Research and Applications (IJERA)

[13] ISSN: 2248-9622 Vol. 2, Issue4, July-August 2012, pp.1097-1101