International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
doi : https://doi.org/10.32628/IJSRST2293127

Experimental Study on The Partial Replacement of Cement with Red Mud in Concrete

Md Tarique Anwar, Prof. Padma Panday
Department of civil engineering, RGPV/Oriental institute of science & technology, Bhopal, Madhya Pradesh, India

Article Info
Volume 9, Issue 3
Page Number : 642-646

Publication Issue
May-June-2022

Article History
Accepted : 10 June 2022
Published : 20 June 2022

ABSTRACT

These days the construction industry is fully developed due to a massive increase within a short period of time in the use of cement and concrete for multiple construction activities. The same rate is expected to continue in the next decade and this may cause global environmental impacts. The raw materials needed to manufacture cement and produce concrete provide less and require more energy for production. This increasing demand is causing a rapid depletion of resources. To overcome this situation, it is very important to use industrial waste and by-products for the manufacture of cement and concrete construction. Red mud is the extensive amount of industrial waste generated during the production of alumina. It has been found that for every 1 ton of alumina 1.2 to 1.3 tons of red mud waste is generated. As red mud has complex properties, the disposal process becomes quite challenging Disposal of this waste was the first prime problem encountered by the alumina industry after the adoption of the Bayer process. The conventional method of disposal of the red mud in ponds has often adverse environmental impacts as during monsoons the waste may be carried by run off to the surface water courses and as a result of percolating may cause contamination of ground water. Further disposal of large quantities of red mud dumped, poses increasing problems off storage occupying a lot space over the years many attempts have been made to find a use for red mud but nobody have proven to be economically satisfactory. Red mud or red sludge is a waste product generated in the industrial production of Aluminum via Bayer's process of refining bauxite enrooted to alumina. With about 150 million tons (Globally) & 9 million tons in India of this hazardous material produced annually, red mud is one of the most important disposal problems in the mining industry. In this study, Mix was designed for M25 grade of conversational concrete. 6 mix were made in which Red mud were substituted by weight of cement in varying proportion 0%, 5%, 10% ,15%,20% and 25%. We evaluated the strength of concrete by performing tests which are

compressive strength, flexural strength at the age of 7days and 28day. Study results revealed that 15% cement can be the optimally replaced by red mud beyond which compressive strength, Flexural strength deceasing. We find out that Compressive strength increase by 3.80 %, Flexural strength increase by 9.42% and replacing cement with red mud at 15%. However, the optimum level was observed as 15% without deceasing in strength. Study results revealed that 15% cement can be the optimally replaced by red mud beyond which compressive strength, Flexural strength deceasing. We find out that Compressive strength increase by 3.80 %, Flexural strength increase by 9.42% and replacing cement with red mud at 15%. However, the optimum level was observed as 15% without deceasing in strength.

Keywords: Red Mud, Bayer's Process, Flexural Strength, Compressive Strength.

I. INTRODUCTION

Concrete is a composite man made material, is most widely used building material in the construction industry. Most ancient structures and historical buildings had been constructed with lime concrete With the advent of cement, the use of lime concrete has been confined to bases for concrete foundations and roof terracing. Concrete as a economic building material is very popular, It is widely used in many types building throughout the world. High impact resistance and greater energy absorption capacity are preferable properties of concrete. Concrete is brittle material with high rigidity, high impact resistance and more energy absorption capacity are required in many applications. The components work together to resist several types of loading. Concrete withstand compression and steel reinforcement withstand tension forces.

The search for new material and new technology, especially in the construction industry is on in view of growing apprehension on protection of environment and conservation of natural resources. Together with this, the problem of waste disposal has become a Crucial concern for planners and engineers in the developing countries.

Industrialization and urbanization are the two global phenomena. Though these are the needs of the society and are mostly inevitable, one has to look into their negative impacts on the global environment and social life. The major ill effect of these global processes is the production of huge quantities of industrial wastes and the problems related with their safe management and disposal. Second problem is the scarcity of land, materials and resources for current developmental activities, including infrastructure

With the enormous increase in the quantity of waste materials from industries, the continuing inadequacy of dumping sites, sharp increase in the transportation and disposal cost and above all the sever antipollution and environment regulations enforced in a number of countries, the waste disposal problem is assuming serious and at times even alarming proportions. It is therefore no wonder that the concept of recycling the waste material and using it further in some form or the other has gathered momentum.

II. METHODS AND MATERIAL

This chapter focuses on the laboratory process for making and testing concrete. To reach a reasonable conclusion about the best percentage of red mud to be

used as a partial substitute for cement in concrete. The best way to determine compressive strength and elasticity is to subdue it until it fails.

The material used in this experiment were locally available and these were

- Ordinary Portland cement.
- Coarse aggregate.
- Fine aggregate.
- Portable Water.

The constituent's material used in this investigating were procured from location sources. These materials are required by conducting various tests. Due the these result we were defined what type of material used. We are using cement, coarse aggregate, fine aggregate and water.

Ingredients	Content (%)
SiO_2	21.8
Al_2O_3	4.8
Fe_2O_3	3.8
CaO	63.3
SO_3	2.04
MgO	2.5

Chemical properties of cement

S. No.	Properties	Results
1.	Fineness	5%
2.	Standard Consistency	34%
3.	Initial Setting time	135 minutes
4.	Final Setting Time	240 minutes
5.	Soundness	10 mm
6.	Specific Gravity	3.11

Physical properties of cement

Chemical composition	Mass %	Physical analysis	Range
Al_2O_3	18.38	Specific gravity	2.64
Fe_2O_3	7.60	pH	10-13
SiO_2	39.5	Particle size	<150µ
TiO_2	16.32	Fine	1000-3000 cm^2 /g
Na_2O	5.89		
CaO	1.91		
P_2O5	0.50		
V_2O5	0.37		
LOI	9.35		

Chemical and Physical analysis of Red mud

Mix No	Age of Specimen	Identification Mark	Area (mm^2)	Maximum Load (N)	Compressive Strength (MPa)	Average Compressive Strength (Mpa)	As per code Target Compressive Strength(Mpa)
1	7 days	0% Red Mud	22500	476700	21.18	21.61	21.17
			22500	514200	22.85		
			22500	468000	20.80		
2		5% Red Mud	22500	499300	22.19	21.73	21.17
			22500	486200	21.60		
			22500	482700	21.45		
3		10% Red Mud	22500	512200	22.72	22.02	21.17
			22500	477300	21.21		
			22500	498200	22.14		
4		15% Red Mud	22500	515100	22.90	22.40	21.17
			22500	500200	21.34		
			22500	497200	22.23		
5		20% Red Mud	22500	496200	22.05	21.87	21.17
			22500	485100	21.56		
			22500	495500	22.02		
6		25% Red Mud	22500	471200	20.94	20.98	21.17
			22500	484200	21.52		
			22500	461100	20.50		

Results of Compressive Strength test after 7 days

Mix No	Age of Specimen	Identification Mark	Area (mm^2)	Maximum Load (N)	Compressive Strength (MPa)	Average Compressive Strength (Mpa)	As per code Target Compressive Strength (Mpa)
	28 days	0% Red Mud	22500	714000	31.73	32.42	31.60
			22500	775100	34.44		
			22500	700100	31.11		
1		5% Red Mud	22500	614200	27.30	31.90	31.60
			22500	756300	33.60		
			22500	783300	34.81		
2		10% Red Mud	22500	744700	33.09	32.11	31.60
			22500	707000	31.42		
			22500	716300	31.83		
3		15% Red Mud	22500	744200	33.07	32.82	31.60
			22500	740400	32.90		
			22500	731100	32.50		
4		20% Red Mud	22500	704500	31.31	31.13	31.60
			22500	695500	30.91		
			22500	702100	31.20		
5		25% Red Mud	22500	684200	30.40	30.94	31.60
			22500	706400	31.40		
			22500	698400	31.04		

Results of Compressive Strength test after 28 days

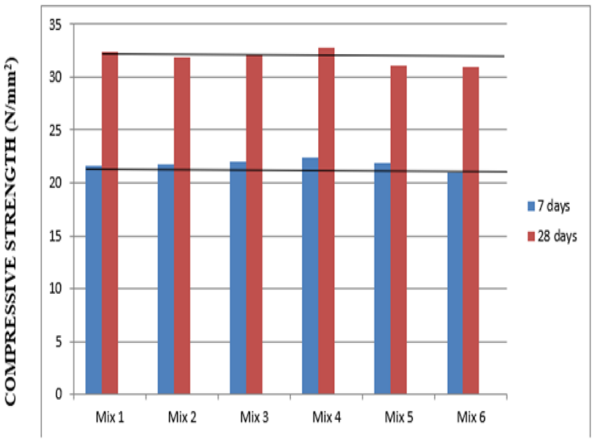
III. RESULTS AND DISCUSSION

This topic deals with the results of all the tests related to thesis study. A serious effort has been made to obtain precise results.

Compressive Strength

Mix No	Identification Mark	After 7 days	After 28 days
1	Red Mud 0%	21.6 N/ mm^2	32.42N/ mm^2
2	Red Mud 5%	21.73 N/mm^2	31.90 N/mm^2
3	Red Mud 10%	22.02 N/mm^2	32.11 N/mm^2
4	Red Mud 15%	22.40 N/mm^2	32.82 N/mm^2
5	Red Mud 20%	21.87 N/mm^2	31.13 N/mm^2
6	Red Mud 25%	20.98 N/mm^2	30.94 N/mm^2

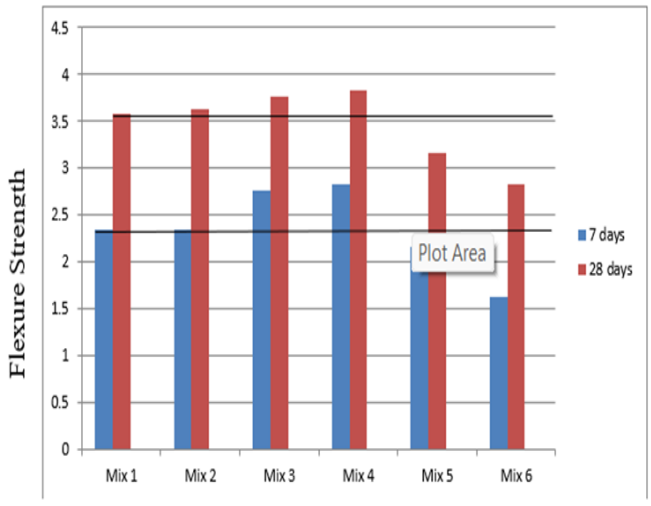
Compressive Strength test



Flexural strength

Mix No	Identification Mark	After 7 days	After 28 days
1	0%Red Mud	2.34 N/mm^2	3.58 N/mm^2
2	5% Red Mud	2.34 N/mm^2	3.63 N/mm^2
3	10% Red Mud	2.76 N/mm^2	3.76 N/mm^2
4	15% Red Mud	2.83 N/mm^2	3.83 N/mm^2
5	20% Red Mud	2.16 N/mm^2	3.16 N/mm^2
6	25% Red Mud	1.63 N/mm^2	2.83 N/mm^2

Compile Results of Flexural Strength test



Flexural strength after 7 days and 28 days curing

IV. DISCUSSION

1. Effect on Compressive Strength

- At 15% Red mud, highest compressive strength (i.e. 32.82 MPa) was obtained which is greater than the target mean strength of 31.60 Mpa.
- At 20% red mud and above the compressive strength starts to decrease.

2.Effect on Flexural Strength

- At 15 % red mud, highest flexure strength (3.83 Mpa) is obtained which is greater than the target flexure strength of 3.5 Mpa.
- At 20% red mud and above flexure strength starts to decrease.

V. FUTURE SCOPE OF THE RESEARCH AND CONLUSION

- Red clay can be used in the manufacture of cement, bricks, tiles, etc. Red clay can be used in fast hardening cement and quick setting cement.
- Red clay leads to a reddish colour in concrete which can be used beneficially in aesthetic appearance. Red Mud can be used advantageously for soil stabilization.
- Effect of various admixtures can be studied in the use of red mud concrete.

VI. REFERENCES

[1]. Daniel Véras Ribeiro, João António Labrincha, Marcio Raymundo Morelli (2011) Potential Use of Natural Red Mud as Pozzolan for Portland Cement, 14(1) edn., : Materials Research.

[2]. D. Linora Metilda, C. Selvamony, R. Anandakumar, A. Seeni (2015) Investigations on optimum possibility of replacing cement partially by redmud in concrete, Vol. 7, Issue 3, pp. 1053-1059 edn., : Academic Journals.

[3]. Sithar Pateliya, Chetan Solanki (2017) Experimental studies on concrete utilizing red mud as a partial Replacement of cement, Vol-3 Issue-2 2017 edn., : IJARIIE-ISSN(O).

[4]. www.google.com and www.wikipedia.com

[5]. IS: 456-2000; Plain and Reinforced Concrete-Code of Practice.

[6]. IS: 10262-2009; Concrete Mix Proportioning-Guidelines.

[7]. Building Materials S.K Duggal.

Cite this article as :

Md Tarique Anwar, Padma Panday, "Experimental Study on The Partial Replacement of Cement with Red Mud in Concrete", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 3, pp. 642-646, May-June 2022. Available at doi : https://doi.org/10.32628/IJSRST2293127
Journal URL : https://ijsrst.com/IJSRST2293127