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Research Paper

Partial Replacement of Sodium Bentonite and Polymer Balls in Cement Mortar

Engineering

KEYWORDS : concrete, bentonite, volume increase, raw materials, polymer balls.

M. Achyutha Kumar Reddy	PG student, Department of Civil Engineering, Vardhaman College of Engineering, Hyderabad, India.
G. Nithin Kumar Reddy	Assistant Professor, Department of Civil Engineering, Vardhaman College of Engineering, Hyderabad, India.
B. Rajkumar Singh	PG student, Department of Civil Engineering, Vardhaman College of Engineering, Hyderabad, India.

ABSTRACT

In concrete the price of cement is higher than other raw materials . The population is keep on increasing but raw materials for making of concrete is not increasing. Present population is enough to get the corresponding raw materials but, the availability of resources are actually reducing by great extent. This major problem can be solved by replacing the material to some extent with the advanced or by making the properties alterations to the conventional concrete. The one such method is making the concrete to increase its volume for the same amount of raw materials. Therefore we get 1.5 times additional output than conventional method. The present study deals with the collection of data regarding the topic and research. The resultant acquired from this experiment increases its volume from 1.5 to 2 times of conventional concrete during mixing, before its initial setting time and reaches a stable state which provides corresponding applications. When the betonite clay is add with cement the it tend to increase that volume to 1.5 times than conventional method. If polymer balls and sodium bentonite clay mixture add with cement the percentage is highly increasing than conventional methods. Several experimental samples are being prepared by adding different proportions to cement in varying proportions and drawn respective conclusions.

INTRODUCTION

Concrete is the mixture of cement, fine aggregate, coarse aggregate and water. Concrete is the non-homogeneous construction material is being used for the constructions of various projects as the major construction material by which the design criterions are satisfied. In concrete the price of cement is higher than other raw materials of concrete

NECESSARY OF VOLUME INCREASE

If we see in general population is keep on increasing but the raw materials for making concrete are not increasing. Present population is enough to get the corresponding raw materials but availability of resources are actually reducing by great extent. We can save our raw materials If we can increase the volume of concrete. Here the challenge is to increase the volume within the certain limits. Since we have to control the increase of volume in direction and time. If the volume increase is fore entire life of concrete that will be the worst material the volume increase should be within initial setting time.

HOW TO INCREASE THE VOLUME

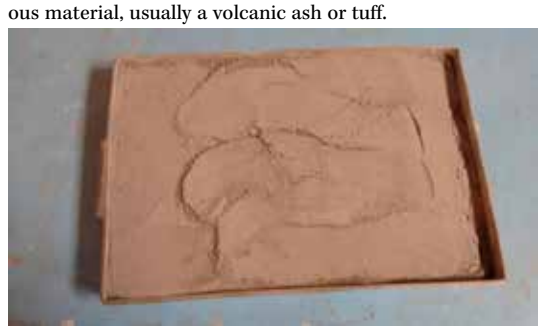
We can increase the volume of concrete by some special materials if we use that materials as partial replacement of cement, fine aggregate and course aggregate. The materials are sodium bentonite and polymer balls.

a) Sodium bentonite:- Sodium bentonite is a kind of expansive clay. This is generally used in installation process of pile foundations. The special property of this material is to increase the volume. Sodium bentonite increases the volume when we add some water to that. The increase of volume is nearly 1.25 to 1.5 times of its initial volume. In general we have 3 types of bentonites

1) Natural Calcium Bentonite
2) Natural Sodium Bentonite
3) Sodium Activated Bentonite

Typical properties of sodium bentonite for commercial grade is SiO_2 61.3% and Al_2O_3 19.8%, for food grade SiO_2 58-61%, Al_2O_3 21-22%, Na_2O 3.7-4.2%, Pb 40ppm Maximum, CaO 2.0-2.5% and MgO3-4%.

The chemical formulae are $Al_2O_34SiO_2H_2O$. A rock composed essentially of a crystalline clay-like mineral formed by devitrification and the accompanying chemical alteration of a glassy igneous material, usually a volcanic ash or tuff.



Natural Sodium Bentonite

b) Polymer balls:-These are the special materials kind of material and are made of a polymer that stores, soaks up and releases water, which in turn can make them ideal for fresh-cut flowers and developing plants capable of increasing volume when come in contact with water for long duration. One 453 grams of the polymer balls holds about 227 litres of water The gel that forms swells by absorbing 30 grams of water for each gram of the water crystals. Since nearly 200% volume is increasing. That is the reason we are using polymer balls as a replacing materials.

Polymer Balls

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EXPERIMENTAL WORK

We are replacing cement with bentinite, polymer balls and 50% of bentonite adn 50% of polymer Balls in cement mortar cubes. The details of test samples are given Tables.

TABLE 1 Details of test Samples by partial replacement of bentonite in cement mortar

S.No	% of partial replacement of bentonite	Weight of samples in grams		
		cement	bentonite	Sand
1	0	185	0	555
2	5	175.75	9.25	555
3	10	166.5	18.5	555
4	15	157.25	27.75	555
5	20	148	37	555

TABLE 2 Details of test Samples by partial replacement of Polymer Balls in cement mortar

S.No	% of partial replacement of polymer balls	Weight of samples in grams		
		cement	bentonite	Sand
1	0	185	0	555
2	5	175.75	9.25	555
3	10	166.5	18.5	555
4	15	157.25	27.75	555
5	20	148	37	555

TABLE 3 Details of test Samples by partial replacement of bentonite + polymerballs in cement mortar

S.No	% of partial replacement of 50 % of bentonite and 50% of polymer balls	Weight of samples in grams			
		Cement	Polymer balls (50%)	Bentonite (50%)	Sand
1	0	185	0	0	555
2	5	175.75	4.625	4.625	555
3	10	166.5	9.25	9.25	555
4	15	157.25	13.625	13.625	555
5	20	148	18.5	18.5	555

CASTING

Casting of the samples take lot of time, nearly 135 samples are casted. Vibrating machine is used for casting. Sample specifications are mentioned in above table. For each specified condition 3 samples are made and finally average of 3 was taken in the calculations. The remolding was done after 24 hours from casting of sample.

CURING

Curing was done for samples as per specified in above tables .I done the curing for 7, 28 and 60 days as specified in the tables. The method of curing is accelerated curing.

TESTING&RESULTS

After completion of curing time of each cube we have to find the specimen strength. We have to taken out the cube from curing tank before the one of testing. Testing was done by Universal testing machine (UTM) of capacity 200 ton. Results are calculated after testing was done as per specified in below tables.

TABLE 4 Results of test Samples by partial replacement of bentonite in cement mortar

S. No	% of partial replacement of bentonite	% of Volume increase	Strength		
			7 days	28 days	60 days
1	0	0	32.6	40.7	42.3
2	5	4.84	25.3	26.6	28.57
3	10	6.96	22.9	21.6	21.85
4	15	8.88	16	18	18.05
5	20	11.77	15.8	17.55	18

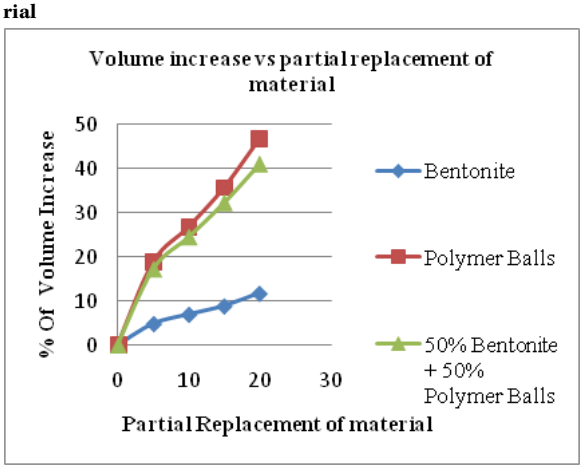
TABLE 5 Results of test Samples by partial replacement of Polymer Balls in cement mortar

S. No	% of partial replacement of polymer balls	% of Volume increase	Strength		
			7 days	28 days	60 days
1	0	0	35.5	42.37	45.22
2	5	18.75	28.75	34.04	35.36
3	10	26.77	27.33	33.55	34
4	15	35.66	16.22	19.15	20.03
5	20	46.72	15.16	17.05	19.89

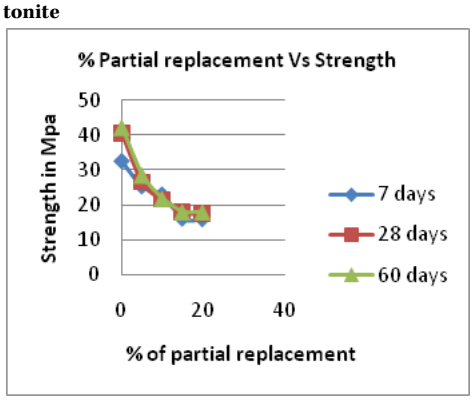
TABLE 6 Results of test Samples by partial replacement of bentonite + polymer balls in cement mortar

S. No	% of partial replacement of 50 % of bentonite and 50% of polymer balls	% of Volume increase	Strength		
			7 days	28 days	60 days
1	0	0	30.4	38.7	40.3
2	5	17.25	22.3	28.6	30.57
3	10	24.55	20.9	26.6	28.85
4	15	32.31	15	16	19.45
5	20	41.13	14.8	15.55	17

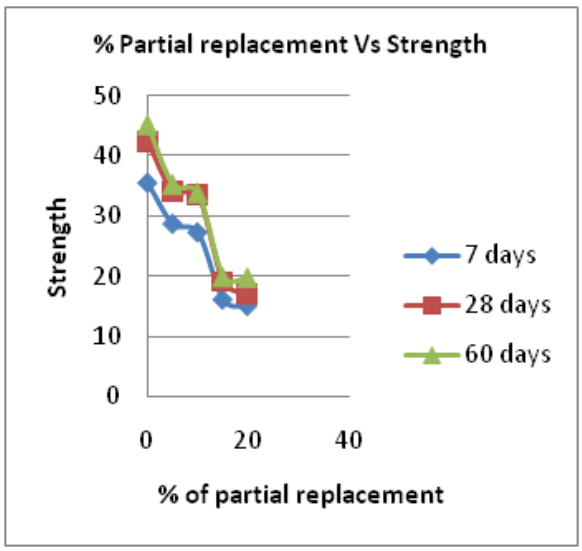
1 GRAPH Volume Increase for Partial Replacement of Material



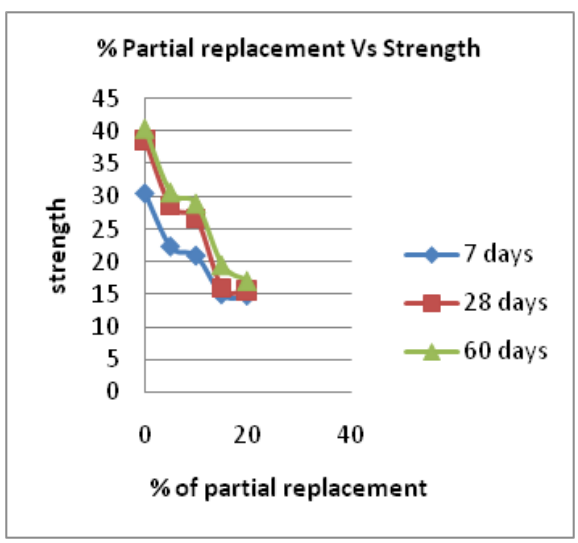
2 GRAPH Strength of cubes by partial replacement of bentonite



3 GRAPH Strength of cubes by partial replacement of Polymer Balls



4 GRAPH Strength of cubes by partial replacement of bentonite + polymer balls



CONCLUSION

After several studies on partial replacement of bentonite and polymer balls in concrete strength is decreasing little bit. But as limit state design walls are non structural members. So we can use this technique for only non structural members like in making of bricks.

FUTURE SCOPE

We are just implementing this technique for cement mortars. If we see the strengths there is some disadvantages due to decrease of strength. If we overcome this disadvantage we can implement this technique to concretes.

REFERENCE

1) M.S. Shettty (2004), Concrete Technology, S. Chand & Co, New Delhi, India. | 2) M.L. Gambhir (2004), Concrete Technology, Tata Mc Graw-Hill publishers, New Delhi, India. | 3) S.K. Duggal (2007), Building material second edition, New Age International Publishers,New Delhi, India. | 4) http://www.physicsforums.com | 5) http://waterbeads.net | 6)http://en.wikipedia.org/wiki/cement_properties | 7)http://www.lenntech.com/groundwater/properties.htm#ixzz3MXHbdYYj | 8)http://en.wikipedia.org/wiki/construction_sand |