iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** XII **Month of publication:** December 2017

DOI:

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor :6.887
Volume 5 Issue XII December 2017- Available at www.ijraset.com

Aerated Concrete Blocks Using Polypropylene Fiber

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Abstract: Lightweight concrete has been used successfully for construction work purpose for many years because of their improved properties such as workability less dead load and durability. The use of light weight concrete is increased rapidly. In this work the investigation on their effect of using polypropylene fiber in light weight concrete is presented through a series of test. Lightweight concrete produced by using fly ash cement by gypsum aluminum powder and water. Based on earlier investigation and experience, water to dry material's ratio is taken as 0.65. The dry density, water absorption and compression strength of blocks are obtained at different percentages (0.5%, 0.75%, & 0.1%) of Polypropylene fiber. The following properties of PP fiber reinforced light weight concrete were obtained on compression strength. After 7, 14 & 21 Days of curing stages.
Keywords: Polypropylene Fibre, Aluminium powder, Fly ash, density, Water absorption and Compressive Strength.

I. INTRODUCTION

The aerated concrete is one kinds of lightweight concrete. Aerated concrete is just too recognized as a cellular concrete. It will be separated into two important types as per the tactic of production. they are non-autoclaved aerated concrete and autoclaved aerated concrete (AAC). Aerated light-weight concrete have various benefits once measured with conventional concrete such as advanced strength to weight ratio, lower coefficient of thermal growth, and good sound resistance as a results of air voids within aerated concrete. This paper is attention to classified of aerated light-weight concrete into foamed concrete and autoclaved concrete. Also, it's exhibits the raw materials utilized in aerated concrete, forms of agent, properties and applications. The properties like strength, durability, toughness, heat transfer and moisture transport are get affected by the pore size and small structure. This porous material will give high acoustic insulation and thermal insulation properties. However, due to enhanced pores the compressive strength of blocks decreases. It's lighter than the conventional clay bricks with a dry density ranging between 600 kg/m3 to 1600 kg/m3. On the basis of methodology of activity, aerated concrete will be of 2 sorts that are autoclaved aerated concrete (AAC) and autoclaved aerated concrete (AAC). During this analysis, focus has been created on concrete victimisation polypropylene Fibre within which water activity of blocks has been done. Non autoclaved aerated concrete using polypropylene Fibre will be created either by using foaming agent or by using air entraining agent. During this analysis, aluminum powder has been used as an air entraining agent. Aerated concrete is obtained by a chemical process that takes place during a fresh mortar. The reaction of aluminum powder with the hydroxide of Ca and alkali from cement and lime liberates hydrogen that forms bubbles within the mixture. The bubbles expand the mixture and concrete rises. The hardened concrete contains voids left by the reaction. Many investigators have studied the compressive strength and density of Autoclaved Aerated Concrete however there's fewer investigations are done on Aerated concrete. S O Rathi, Khandve P. V, have examined the density and compressive strength of aerated concrete blocks. From the experimental results, they need found that the density of AAC blocks 740 kg/m3 as compared to 2500 kg/m3 for conventional concrete and therefore the compressive strength of 4.5 MPa are achieved on 650 kg/m3 density.

S. Alsadey, presented influences of polypropylene fibre on strength of fibre, and a pair of the concerns polypropene fibre content compressive strength of 28 N/mm2 was observed against compressive strength 25 N/mm2 at 0 the concerns hence increase of 12 the concerns compressive strength was obtained. Radhika Shukla, have compared the burnt clay bricks with aerated concrete blocks. The results shows that compressive strength of aerated blocks is 3-4 MPa, dry density of blocks ranging between 600 kg/m3 to 800 kg/m3, and fire resistance for blocks are 7 hours ,which are higher than burnt clay bricks. Desani Parth, Soni Mansi Et al. , have examined the mechanical properties of aerated autoclaved concrete blocks and that they have concluded that compressive strength of Aerated Autoclaved Concrete is between 3-4 MPa and dry density ranges between 550 kg/m3 to 650 kg/m3.

A. Need

Presently the interest for alternative material is consistently increasing with the expansion in structures for housing and business purposes in both urban and rural areas. The natural resources utilized to manufacture huge quantity of building materials have the

unfavorable result on surroundings and human being by reducing the natural resources, using energy and making pollution. These aerated concrete polypropylene fiber Block produced by using fly ash will helps in decreasing the difficulty of disposing fly ash. Further, these light weight aerated concrete blocks helps in easy transfer and faster construction and decrease in dead load. AAC using polypropylene fibre in light weight concrete may further improve the properties.

II. MATERIALS USED

The following raw materials are used in the manufacturing of aerated concrete using polypropylene fibre Block -

1) *Cement:* Cement is used as a binding material in aerated concrete using polypropylene fibre Block of (Ordinary Portland Cement Ultratech) of 43 grade is used in the production process. Cement of this grade is available in local market.

Table 1. Properties of cement

|S. No.	Physical property	Results
1.	Specific gravity	3.11
2.	Initial setting time	95 minutes
3.	Final setting time	145 minutes
4.	Fineness	2.5 %

2) *Fly ash:* Fly ash used in this experiment is taken from the Parichha thermal power plant, Jhansi, U.P.

Table 2. Properties of Fly ash

S. No.	Physical property	Results
1.	Specific gravity	2.34
2.	Bulk density	1.12 gm/cc

3) *Quicklime:* Quick lime are obtained by calcining limestone at temperatures above 900°C.Quicklime taken for this research is taken from INDUS MINERAL PRODUCTS OF INDIA, KATNI, M.P. Gypsum: Gypsum ($CaSO_4.2H_2O$) is easily available in market and used in powder form.

Table 3. Properties of Gypsum

S No.	Physical property	Results
1.	Specific Gravity	2.34

4) *Aluminium powder:* A fine grey colour, uniform, smooth metallic powder available in market is used in this experimental process, having a molecular weight 26.98. Aluminum Powder purchase from CDH company pvt ltd.

5) *Polypropylene fibre:* polypropylene Fibers based on 100% Virgin high tenacity polypropylene straight fibers and fibrillated mesh fiber in graded lengths, with Chemical Surface Treatment for uniform dispersion in wet concrete. Purchase from Dolphin floats Pvt. Ltd, pune.

Table 4. Properties of Polypropylene fibre

S No.	Physical property	Results
1.	Sp. Gravity	0.92 g/cc
2.	Melting Point	165^0C
3.	Thermal Conductivity	Low
4.	Aspect ratio	30

6) *Water:* Water is an important ingredient that helps in chemical reaction. Potable water is used in this process.

III. METHODOLOGY

A. *Quantities of materials*

Percentage of different materials is taken which are listed in table 5 below.

1) *Mixing:* Quantity of water is taken as 0.65 times of weight of dry material. Water is heated up to 70ºc to make the end temperature of mixture upto 40ºc for the chemical reaction of aluminum powder with other materials. The slurry is formed by mixing fly ash with water for 3-4 minutes in a container. On one hand dry material materials i.e Cement, Lime, Gypsum and

Aluminium powder, Polypropylene fibre are properly mixed in dry form. Dry material is then mixed with slurry and keeps on stirring for 2-3 minutes. A constant amount of aluminum powder 0.8% is added in all the samples. The quantity of polypropylene is varied in the sample as shown in table 5.

Table 5. Quantities of materials in percentage by weight

Sample Designation	Cement	Fly Ash	Quicklime	Gypsum	PP fibre	Water/dry material
SC	40	50	7	3	0	0.65
S1	40	50	7	3	0.5	0.65
S2	40	50	7	3	0.75	0.65
S3	40	50	7	3	1.00	0.65

2) *Moulding:* Oil is applied in 70.6mm*70.6mm*70.6mm cube moulds and the mixture is poured in the moulds. Mould is filled up to two third of the total height. It was observed that the concrete expanded and filled the mould completely.
3) *Curing:* Cubes are demoulded after 24 hours. Cubes are kept in air for two hours at room temperature for drying. Curing was done by immersing the cubes in water at room temperature for 7 days, 14 days and 21 days.

IV. RESULTS

After completing the curing, the density, Water absorption and Compressive Strength of cubes are obtained at different stages of curing.

1) *Expansion in volume:* Expansion in volume of cubes 41.82 %.
2) *Water Absorption Test:* The cubes are immersed in water for 24 hours. After that, Remove the cube from water and wipe out the traces of water with cloth and weight the cube. Then, dry the cube in oven for 24 hours and weigh it..Water absorption test of aerated concrete using polypropylene fibre are shown in following table.

Table 6. Water absorption test

Samples	Water Absorption (%)
SC	36.80
S1	38.02
S2	38.93
S3	39.45

A. *Compressive Strength test:*

This test is performed by compressive testing machine. The compressive strength of aerated concrete using polypropylene fibre of blocks was obtained at the age of 7 days, 14 days and 21 days. The results of the tests are shown below:

Table 7. Compressive strength

Sample	Compressive strength in N/mm^2					
	7 days	% change	14 days	% change	21 days	% change
SC	1.63	0	2.38	0	3.72	0
S1	1.83	12.26	2.88	21	4.55	22.31
S2	2.10	28.83	3.39	42.43	5.27	41.66
S3	1.98	21.47	3.20	34.45	4.89	31.45

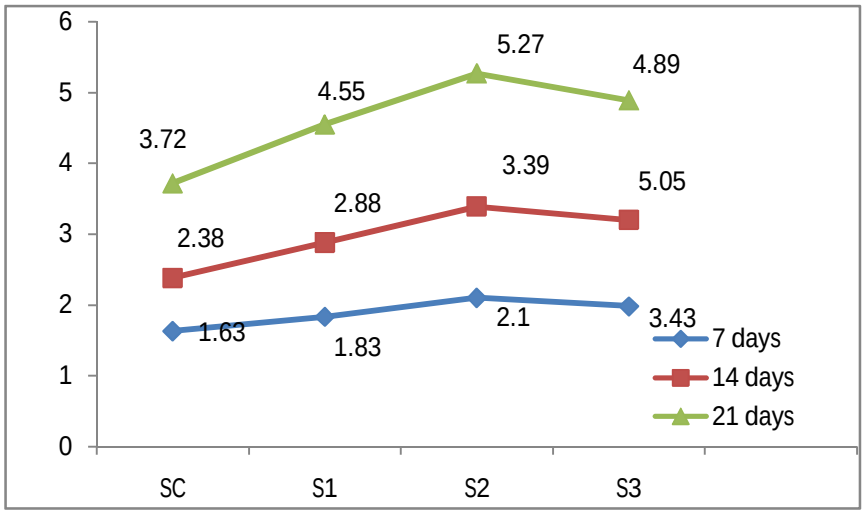

Figure 1. Compressive strength of aerated concrete using polypropylene fiber Block

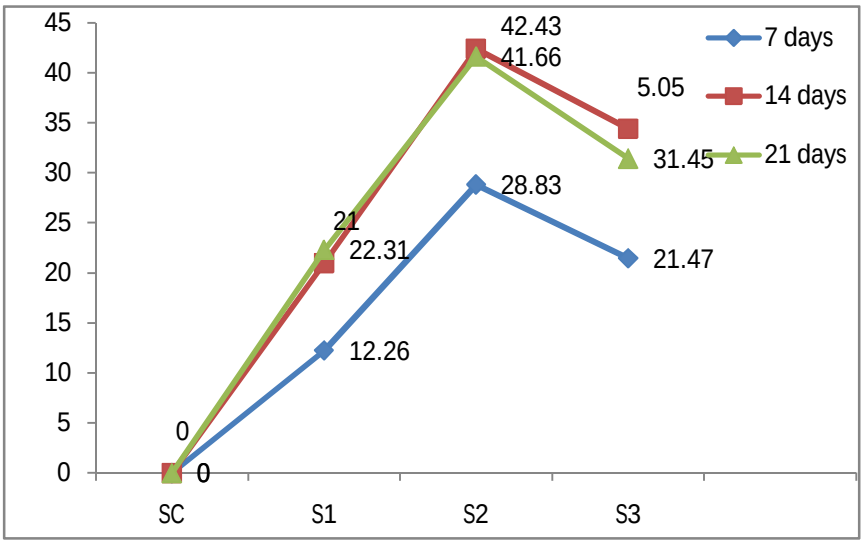

Figure 2. Percentage change of aerated concrete using polypropylene fiber Block

V. CONCLUSIONS

The following conclusions are drawn from this experimental work:

1) Water absorption of aerated concrete using polypropylene fiber Block increases with increase in fiber content.

2) Light weight concrete polypropylene fiber block is lighter than conventional clay bricks.

3) Compressive strength of sample S2 (0.75% of PP fiber) is 41.66% higher than control.

4) S1 and S2 Sample of aerated concrete using polypropylene fibre block have a compressive strength 4.55 N/mm2 and 5.27 N/mm2 respectively which is more than the strength of third class brick.

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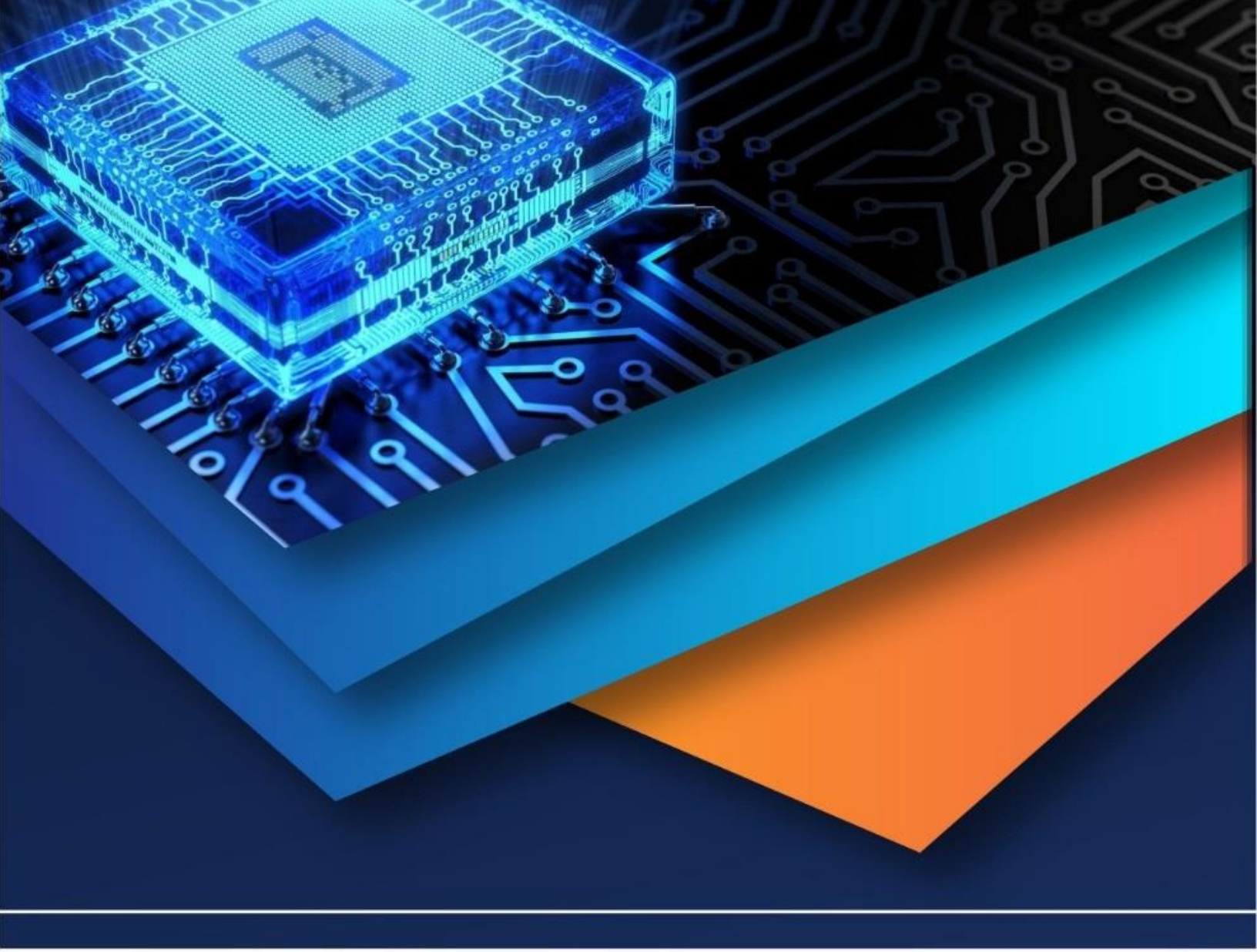

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