UTILIZATION OF FIBER REINFORCED PLASTIC WASTE IN AUTOCLAVED AERATED CONCRETE BLOCKS

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Abstract : As there's been a consistent increase in population, abundant amount of fiber reinforced plastic waste is been generated which further causes adverse effect on the environment. Therefore, the need of the hour is to recycle the Fiber reinforced plastic waste for optimal disposal of waste and to preserve the land in which all the waste is been dumped. One of the ways of doing so is by the use of Fiber reinforced plastic waste in manufacturing of Autoclaved aerated concrete block. This paper represents the pioneering use of fiber reinforced plastic waste in different proportion to increase the strength of the block. This paper also represents the test which was performed on the said blocks and also its result.

IndexTerms **- Fiber reinforced plastic waste, Autoclave aerated concrete block, Recycling.**

I. INTRODUCTION

Fiber reinforced plastic is a composite material made of a polymer matrix reinforced with fibers. The fibers may usually be glass, carbon or basalt and the polymer is usually epoxy or polyester [3]. Fiber reinforced plastic is one of the many gifts of technology that has influenced human life in numerous spheres. As the name suggests Fiber reinforced plastic are the ones which contain fibers of other materials that add strength, flexibility, durability and other virtues to the plastic [5]. They are been distinguished by five attributes that give them an edge over the other material i.e. longer life cycle, increased corrosion resistance, improved fire resistance, easier design and high strength to weight ratio.

Around 50 years ago fiber reinforced plastic was been used in making of boats and bath tubs. Now, they are been widely used in construction industry, automobile, furniture, electrical equipments and medical equipments as well [2]. Due to their light weight and their insulation properties fiber reinforced plastic is also the material of choice in the manufacturing of the fiber reinforced plastic cylinder which are used for transformers.

Even though Fiber reinforced plastics are extremely useful and comfortable during their entire life, most of their virtue become great hurdles in disposing the waste which is been generated while manufacturing of the FRP cylinders. Fiber reinforced plastic are non-biodegradable so they cannot be assimilated in nature by any means and nor they can be used in any economically viable manner [2].

At present Fiber reinforced plastic waste can only be disposed by either incineration or dumping it in secured land fill. The first method can causes a lot of air pollution and the second is economically unviable as the cost of land increasing at a very fast rate. Moreover, since Fiber reinforced plastic is totally non biodegradable and land filling amounts just to accumulation the problem and postponing its solution [4].

The present study was carried out with the aim to find the way by which the Fiber reinforced plastic waste generated by Pramod Fiber Plast, Nasik can be properly utilized. One of the way to utilize this plastic waste was to use Fiber reinforced plastic waste as an additive in the making of autoclaved aerated concrete blocks.

II. LITERATURE REVIEW

J. Shri Indhu and E. Prabakaran (2017) worked on the usage of PET fiber in a concrete tile, and it was seen that there was an increase in flexural strength when the plastic fiber of 10-15% was used.

Mehdi Seghiri1and Djamel Boutoutaou(2017) worked on the usage of HDPE in varied proportion with sand in roof tile and it was seen that there was an increase in permeability and decrease in density with increasing plastic dosage.

B.Shanmugavalli and K.Gowtham (2017) used LDPE as an replacement of cement in addition to quarry dust, coarse aggregate and ceramic waste, there was no such increase in compressive strength when compared to concrete paver block.

Amit sahu and Prof. Archana Tiwari (2017) used polypropylene fiber in various proportions in AAC block and from the result it was seen that there was increase in the compressive strength by 44.6% when compared to regular AAC block

III. PURPOSE OF STUDY

The rapid pace of infrastructure development in the country has also led to the shortage of construction materials and increase production of waste. Fiber reinforced plastic waste which is a non bio degradable material and causes a significant amount of pollution, necessitating this research attempt at exploring the way to use this fiber reinforced plastic waste as an additive in the making of the autoclaved aerated concrete blocks.

IV. RESEARCH OBJECTIVE

The main objective of the study was to determine optimum percentage of fiber reinforced plastic waste dosage in autoclaved aerated concrete block

V. DATA COLLECTION

Fiber reinforced plastic waste sample was collected from a factory naming Pramod fiber plast located in Nasik. This factory is in to the making of fiber reinforced plastic cylinders which are used for transformers. The waste which was collected was in fiber form of varying size and thickness. The waste was a residue which was formed while the making of FRP cylinders [Refer fig 2]. Melting point of this waste was found out by capillary method which came out to be more than 300°C. Approximately 2 ton of FRP waste is being dumped every month into landfills by this factory.

VI. EXPERIMENTAL WORK

Raw materials which were used for making of Autoclaved aerated concrete blocks are fly ash, lime, cement, aluminium powder and gypsum. All the materials are machine mixed and then water is added to the mix and hydration starts with cement forming bond between fine aggregate and cement paste. While mixing process expansion agent and FRP waste is added to the mix in which

Fig 1: Pouring of plastic waste in the mixture

expansion agent helps in increasing the volume by 2 to 5 times more than that of the original volume of the paste [1]. Aluminium powder reacts with calcium hydroxide which results in the formation of the microscopic air bubble thus increasing the volume of the paste. The paste is kept in the mould for around 180 minutes so that slurry can expand. The hydrogen gas which is a lighter gas formed in this process bubbles out of the mixture and is replaced by air, which is a denser gas. The increase in the volume is totally dependent on the amount of aluminium powder. Once the fermentation process is done then the mould was cut in blocks of size 600*150*150mm and then it was passed in to autoclave. Autoclave is a strong, pressurized, steam headed vessel. This is the place where the autoclaved aerated concrete block is cured. The blocks are kept for around 13 hours in the autoclave at a temperature of 200°C and pressure of around 16 MPa. After the blocks have come out of autoclave then the block samples are further taken in for testing.

Fig 2: Compressive Strength Test.

The whole process phase of Autoclave aerated concrete block production right from the mixing of the raw material to the packaging and shipping is shown below in the block diagram:

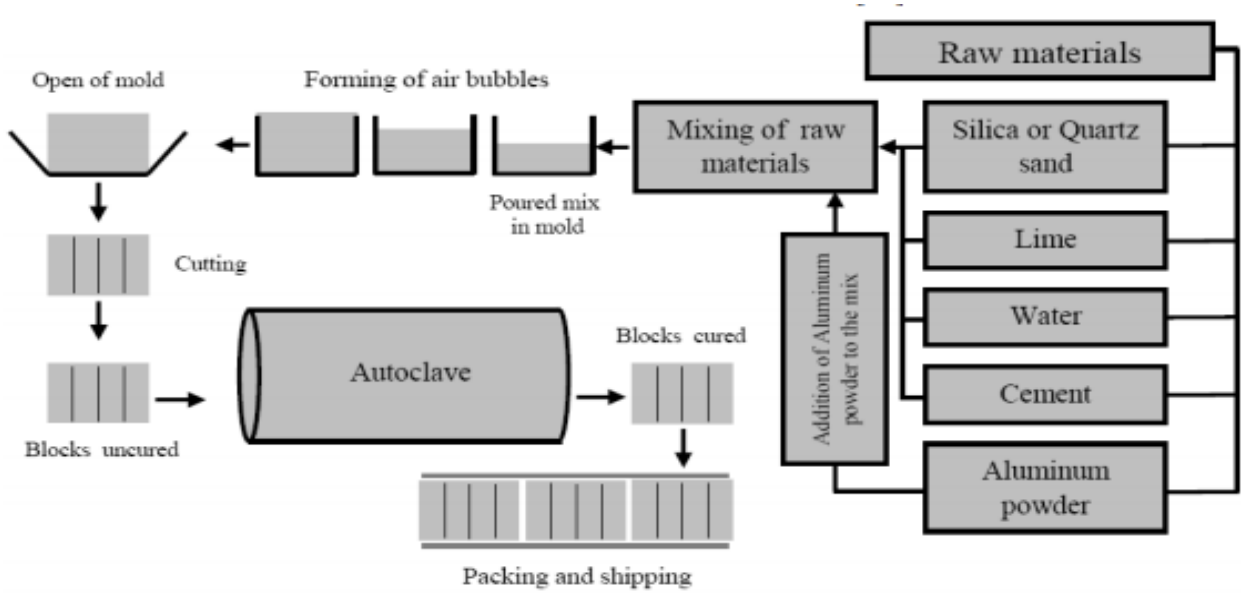
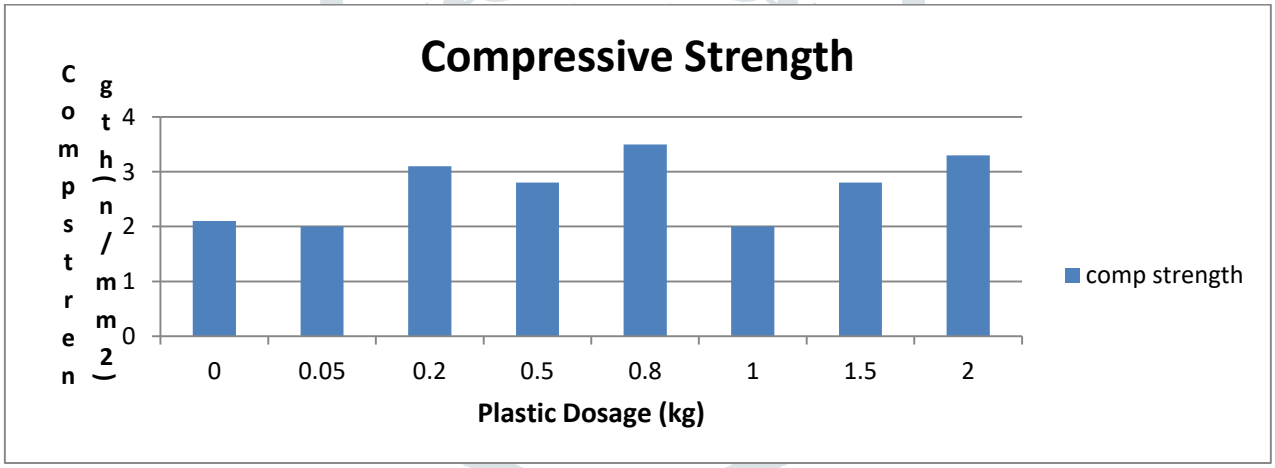


Fig 3: Process of Autoclaved aerated concrete block production.

VII. EXPERIMENTAL RESULTS

The Graphical representation shows the compressive strength after keeping the block for 24 hours in oven with addition of several dosage of fiber reinforced plastic waste. The minimum compressive strength was observed with 0.05kg of plastic waste i.e. 2 N/mm² and maximum compressive strength was observed with 0.8kg of plastic waste i.e. 3.5N/mm².



Graph 1: Compressive Strength of AAC Block

The compressive strength observed with 2kg of plastic waste is 3.3N/mm² which is 6% less than that of 0.8kg plastic waste but 57% more than 0kg of plastic waste. Thus instead of using 0.8kg of plastic waste one can use 2kg which will eventually increase the amount of waste used in AAC block by 2.5 times.

VIII. CONCLUSION

Based on the experimental investigation the conclusion that can be made is that, we can use fiber reinforced plastic waste in AAC block as there was an increase of 67%in the strength of AAC block. The quality of the block was also compared with the regular AAC block and there was no change observed in the quality of the block as well. Thus one can conclude that if we use 2 kg of plastic waste in each mould made in that factory, then a total of 8 tons of plastic waste can be made in to use instead of dumping the same into the landfills. As the plastic waste is available free of cost, thus it does not ad any money in to making of the AAC block. Only the transportation cost may be added which may increase the price of the blocks by some amount.

IX. ACKNOWLEDGMENT

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