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Evaluation Of Strength Of Geopolymer Brick Using Prosopisjuliflora Ash As Partial Replacement Of Fly Ash

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Abstract - The traditional masonry units like brick and regular cement blocks are not considered as sustainable, because it consumes fossil fuel & top fertile soil. In current situation the manufacturing of cement industries produces large extent of carbon-dioxide to nature. So we utilizes waste material such as prosopisjuliflora ash. PJA is the residue powder left after the combustion of wood. It is also difficult to decompose and also absorbs more groundwater. Therefore using PJA as a partial replacement of fly ash providing the green and clean environment. In this project a study has been carried out on manufacturing of geopolymer binder based bricks using fly ash, prosopisjuliflora ash and fine aggregate. Here the ProsopisJuliflora Ash as partially repaced to fly ash in geopolymer bricks of various percentages of 0%, 10%, 30% and 50%. Geopolymer bricks are relatively light weight and more flexible as compared to normal brick. These bricks are potentially ideal material for earthquake prone areas. The geopolymer bricks are good sound absorbent. So, these bricks can be used in auditoriums. The project result reveals that 10% of PJA enhance the compressive strength of geopolymer brick compared to other replacements.

Keywords – Prosopisjuliflora ash, fly ash, sand, sodium hydroxide, sodium silicate, compressive strength.

I. INTRODUCTION

Geopolymer concrete, an unindustrialized material in India, isgoing to be a revolution not only in the research field but also in the construction industry. Geopolymer isan unique class of inorganic polymers are new promising binders and are manufactured by the activation of a solid state alumina-silicate with a highly alkaline activating solution using thermal drive. In the recent past, Geopolymer binders have been found to be the best alternate to cement binders due to its environmental pleasantness. Its performance in aggressive environment is promising and these binders could become a replacement for cement concrete in aggressive situation where cement concrete is vulnerable.

Cement is the most sought after material by the concrete industry throughout the world. Day by day, the requirement of cement in the concreteindustry and in the construction field is increasing quite alarmingly. The production of such huge quantity of cement leads to the emission of 80% of that quantity of CO_2, the greenhouse gas, into atmosphere. The production of 1 tone of rock based Geopolymer cement requires 3.5 times less energy than that of Portland cement. It generates 0.184 to 0.218 tones of CO_2, from combustion carbon-fuel, compared with one tone ofCO_2 for Portland cement (Joseph Daidovits 2010)

This emission of green house gas into atmosphere is the prime reason for global warming, a worrisome factor for the humankind and Scientists across the globe are trying hard to find an alternative to disturbing factors like emission of green house gases into the atmosphere. Such hard

work by Scientists has led to the invention of Geopolymer and Geopolymerconcrete which are more suitable in the construction industry. Even high strength prefabricated structural elements of the desired size could be manufactured using this novel material.

II. MATERIALS

A. Cement - Cement used for the test was Ordinary Portland Cement of 53 grade confirming to IS 8112-1989.

Table-1: Properties of cement

Physical property	Test results
Specific gravity	3.29
Fineness modulus	2.2
Initial setting time	60 min
Final setting time	600 min

B. **Fine aggregate -** Natural river sand was used as fine aggregate. The properties sand conducting as per IS 2386 (part – I)

Table-2: Properties of fine aggregate

Physical property	Test results
Specific gravity	2.65
Fineness modulus	2.8
Water obsorption	0.65%

C. Water - Portable water free from impurities and salt used for casting and curing the mortar bricks as per IS 456-2000. Water cement ratio is 0.3.

D. Fly ash - Low cost by-product of burned coal.it is obtained from thermal power plant.

E. Prosopisjuliflora ash (PJA) - The prosopisjuluflora used for this study were acquired from the near by areas in alangulam and converted as ash

Table-3 : properties of PJA

Physical property	Test results
Specific gravity	2.2

Table-4 : chemical properties of PJA

S.No	Particular	Value (%)
1	SiO2	20.25
2	Al2O3	5.04
3	Fe2O3	3.16
4	CaO	63.61
5	MgO	4.56
6	Na2O	0.08
7	K2O	0.5
8	Loss on ignition	3.12

Figure 1.ProsopisJuliflora Ash (PJA)

F. Alkaline solution - The common materials used as alkaline solution in producing fly ash based geopolymer are sodium silicate and sodium hydroxide. Usually either of this material was

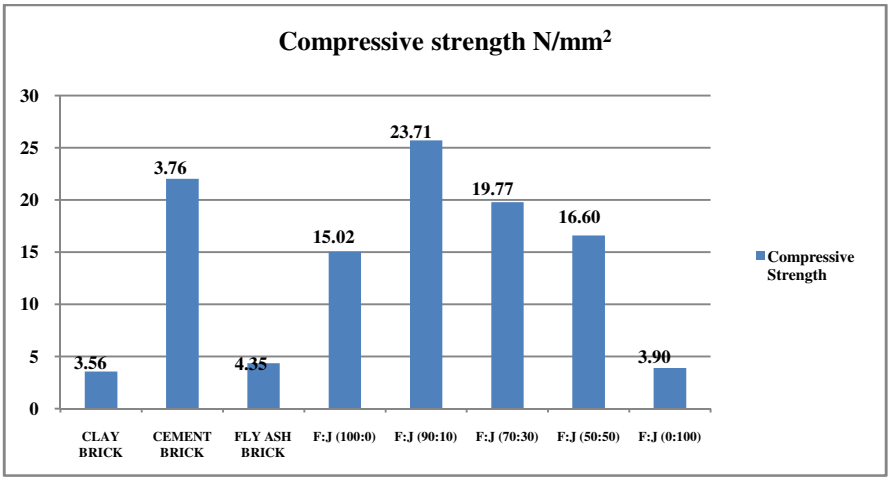
mixed with sodium hydroxide to produce the alkaline solution. The alkaline solution was prepared a day before it is mixed with fly ash. Then the materials are mixed together with fine aggregate to form mortar and curing process been done. To produce high strength geopolymer, the optimum sodium silicate to sodium hydroxide ratio was in range of 0.67 to 1 meanwhile, the concentration of NAOH between 10 and 20 M give small effect on the strength

III. MIX DESIGN

Table-5 Quantity of materials with a constant molar ratio of 1:2

Proportion	Sand (Kg)	Flyash (Kg)	PJA ash (Kg)	Molar Ratio	Na_2SiO_3 (kg)	NaOH (kg)
100:0	2.400	1.200	0	1:2	0.360	0.180
50:50	2.400	0.600	0.600	1:2	0.600	0.300
70:30	2.400	0.840	0.360	1:2	0.480	0.240
90:10	2.400	1.080	0.120	1:2	0.360	0.180

IV. TEST RESULTS



V. CONCLUSION

From the above experimental studies we can conclude that,

- It is possible to prepare geopolymar blocks by replacing all the traditional ingredients including the water.
- The unit weight of geopolymer bricks is slightly higher than that of the other types of bricks.
- In this project, we added various percentages of prosopisjuliflora ash (PJA- 10%, 30%, 50%, 100%) in the geopolymer mix and we tested the prepared bricks & cubes.
- From the test results, the compressive strength of the bricks & cubes are increased while adding 10% of PJA in mix.so it is suitable for construction.
- Moreover, it reduces the construction cost and demand of cement and it also reduces the environmental pollution due to prosopisjuliflora.

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