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Hardened Properties of Bagasse Ash GPC and Ricehusk Ash GPC

Tony Suman Kanth D¹, K U Muthu²

P.G.Student, Dept. of Structural Engineering, Brindavan College of Engineering, Dwarkanagar, Bangalore, India¹

H.O.D, Dept. of Civil Engineering, Brindavan College of Engineering, Dwarkanagar, Bangalore, India²

ABSTRACT: The real issue world facing today is the environment contamination. In construction field mainly by cement production which discharges pollutants bring about environment contamination. Usage of industrial waste we can decrease the contamination impact. In this aspect the geo polymer concrete comes to role i.e., in the present study to prepare the geo polymer concrete the normal portland cement is completely supplemented with fly ash, sugarcane bagasse ash and rice husk ash. Alkaline liquid are utilized for the binding of materials. The liquid utilized in this study for the polymerization are the solution of sodium silicate and sodium hydroxide. Distinctive percentage of sugarcane bagasse ash and rice husk ash is utilized has the binders with fly ash. Fly ash is supplemented by including 0%, 10%, 30% and 50% of bagasse ash and rice husk ash which is the bi product of sugarcane industry and rice mill respectively. The mechanical properties such as compressive, split tensile and flexural strength of geopolymers is brought about in this report to know the role played by supplementing fly ash binders partially by sugarcane bagasse ash and rice husk ash on the strength parameters of geopolymers concrete.

KEYWORDS: Alkaline Liquid, Polymerization.

I. INTRODUCTION

In the current circumstance, the most serious issue of humanity on this planet is the earth contamination which causes environmental awkwardness. There are numerous reasons which delivers natural contamination. In the development business the primary material/fixing utilized for the creation of quality in cement will be cement. There will be parcel of discharge of carbon di-oxide amid the generation of cement. The fundamental dependable industry for the emanation of carbon di-oxide is the cement industry, on the grounds that the generation of one ton of Portland cement discharges give or take one ton of CO₂ into the environment. There are two unique sources of carbon di-oxide discharge amid the creation of cement, the biggest source to function rotary kiln is the Combustion of fossil fuels and the other one is the synthetic procedure where lime is calcined through limestone in the cement kiln which additionally creates carbon di-oxide. In 2014 around 3980 crores huge amounts of carbon di oxide are discharged on the planet and in that around 7% of carbon di-oxide discharge is contributed from India. The crude materials utilized for the manufacture of cement are mud, lime stone furthermore different minerals which are acquired from the quarry process which likewise causes natural debasement. Around 1.6 tons of crude materials are needed for the generation of 1 ton of cement and lime stone take longer time for its formation than the rate at which the humans use it.

A few systems are in advancement for supplementing the utilization of portland cement in solid so as to illuminate the a worldwide temperature alteration issues. In such manner, the progressive improvements is the geopolymers concrete identified with novel materials bringing about easy and naturally neighbourly material as distinct option for portland cement. These incorporate the use of supplementary cementing materials, for example silica smoke, fly ash, metakaolin, rice-husk powder and bagasse ash, ground granulated blast furnace slag etc. are created has the substituting binders to the portland cement.

Davidovits was the first to present the geopolymers technology in 1978. The selection of the geopolymers technology impressively demonstrates that it could lessen the CO₂ outflow created because of cement businesses. Davidovits suggested that through the polymeric response of aluminium and silican which are the basic fluids in source

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materials of topographical cause folios could be created or from the by-item materials, for example, fly slag and rice husk powder. The mineral polymers coming about because of geochemistry speaks to the fasteners as geopolymers which was termed by Devidovits. As novel designing materials was developed by the geopolymers with the possibility to shape a generous component of an ecologically feasible development furthermore to the building merchandise industry. At the point when contrasted with customary solid they have a little nursery foot shaped impression, and they are likewise financial since they use plentifully accessible squanders.




In such manner, the geopolymer technology shows significant guarantee for the utilization in solid manufactory as an option fastener for the portland cement. Regarding an unnatural weather change, the technology of the geopolymer could steadily diminish the carbon-di-oxide outflow to the environment which was freed by the cement businesses as demonstrated by the point by point examinations of Gartner (2004).

Once geopolymer technology is prevalent around the globe than the utilization of fly ash will likewise be expanded. In the present stage fly ash the waste material can be gathered free of expense from the RMC plants however as geopolymer technology is expanded step by step and the expense of fly ash will likewise be expanded thus to diminish the rate of expense, substitute materials like rice husk ash and bagasse ash is supplemented by fly ash in the rate of 10, 30, 50 by the volume of fly ash and the quality of cement is checked for compression, tension and flexure.

II. RELATED WORK

Conventional techniques are utilized has Portland cement concrete. The same methodology is taken after for the manufacture of geopolymer concrete. All materials needed for the creation of geopolymer concrete were proportioned strategy by B.V. Rangan and studied in past chapter. Aggregates are taken saturated surface dry condition. Alkaline liquid arranged by utilizing sodium silicate and sodium hydroxide based on molarity one day prior. After the cast of concrete it is placed one day for ambient curing and afterward in oven for 24 hour at 60°C for heat curing. At that point the examples were tested for 7 days and 28 days.

Test specimen utilized

-  Cubical specimen of size (150x150x150)mm
-  Cylindrical specimen of size 300mm height and 150mm diameter
-  Beam specimen of size (100x100x500)mm

Saturated Surface Dry Aggregate

The aggregates were cleaned and dried in daylight such that it should be free from all other dust and outside particles and these are kept in plastic buckets to avoid dampness content enter into the aggregates.

Preparation of Alkaline Liquid

12 Molar solution of sodium hydroxide and the solution of sodium silicate is taken. 12 Molar sodium hydroxide is prepared by mixing $12 \times 40 = 480$ gm of pellets of commercially available NaOH in 1000 ml of water. More heat is liberated from the solution during mixing hence the solution preparation process should be held in the water tub with continue stirring. After 15 minutes the sodium silicate is added which is semi liquid in state and stirred well the semi liquid state turns into liquid state this alkaline liquid should be prepared one day before casting.

MIXING PROCEDURE

Fly ash, Bagasse ash or Rice Husk ash of different volume i.e., of 10%, 30%, 50% of fly ash and aggregates were initially combined dry in 80 litres capacity pan mixer for around 3 to 4 minutes. Aggregates utilized as a part of this mix are saturated surface dry condition aggregates. At that point the alkaline liquid prepared one day prior is mixed with retarders or accelerators super plasticizer and the additional water if required included. The liquid component that is alkaline liquid is gradually added to the pan with continuous mix with the dry material this mixing should be again proceeded up to five minutes then the prepared fresh concrete is poured in the moulds arranged and packed has same as conventional concrete.

Curing of Geopolymer concrete

After the preparation of fresh concrete the concrete is filled in the moulds and left in ambient curing for 24 hour and afterward it is demoulded and kept in oven for 24 hours at 60°C temperature for curing. The curing temperature will likewise impact the strength of concrete. In geo polymer concrete chemical response begins and the

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polymerization process happens in the curing procedures. Then the specimens were then permitted to cool in air and the testing procedure is carried out for seven and twenty eight days.

Test Methods Involved in the Study

- ✚ Compressive Strength Of Geopolymer Concrete
- ✚ Split Tensile Strength Of Geopolymer Concrete
- ✚ Flexural Strength Of Geopolymer Concrete

III. MIX DESIGN PROCEDURE

Ingredients Required

Fly ash	→ (class F) with low calcium
Alkaline liquid to binder ratio	→ 0.3
Molarity of NaOH solution	→ 12Molar
Ratio of Na ₂ SiO ₃ solution to NaOH solution by mass	→ 2.5
Aggregates	→ 75 to 80% of mass of concrete
Bagasse ash	→ In varied % of fly ash
Rice husk ash	→ In varied % of fly ash
Super plasticizer	→ 2.5% of fly ash

DESIGN PROCEDURE

Step 1

Wet density of geo polymer concrete = 2400 kg/m³

Step 2

Mass of Combined Aggregate = 77% of mass of concrete
= (77*2400)/100
= 1848 kg/m³

Step 3

Mass of binders to alkaline liquid = 2400 – 1848
= 552 kg/m³

Step 4

Alkaline liquid to binders ratio by mass = 0.3

Step 5

Mass of fly ash = 552/(1 + 0.3)
= 424.62 kg/m³

Step 6

Mass of alkaline liquid = 552 – 424.62
= 127.38 kg/m³

Step 7

Ratio of Na₂SiO₃ solution to NaOH solution by mass 2.5

Step 8

Mass of sodium hydroxide solution = 127.38/ (1 + 2.5)
= 36.39 kg/m³

1 molar = 40gm of sodium hydroxide pellets in 1000 ml of water

12 molar = 12*40 gm of sodium hydroxide pellets in 1000 ml of water

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$$\begin{aligned}\text{Total sodium hydroxide solution} &= (12 \times 40 + 1000) \\ &= 1480 \text{ kg/m}^3 \\ \text{\% of sodium hydroxide solids in NaOH solution} &= (480 / (1000 + 480)) \times 100 \\ &= 32.43\%\end{aligned}$$

$$\begin{aligned}\text{Sodium hydroxide solid} &= 0.324 \times 36.39 \\ &= 11.79 \text{ kg}\end{aligned}$$

$$\begin{aligned}\text{Water} &= 36.39 - 11.79 \\ &= 24.6 \text{ kg}\end{aligned}$$

Step 9

$$\begin{aligned}\text{Mass of sodium silicate solution} &= 127.38 - 36.39 \\ &= 90.99 \text{ kg/m}^3\end{aligned}$$

Step 10

$$\begin{aligned}\text{Water content in sodium silicate solution} &= 55.9\% \\ &= 0.559 \times 90.99 \\ &= 50.86 \text{ kg} \\ \text{Solids} &= 90.99 - 50.86 \\ &= 40.13 \text{ kg}\end{aligned}$$

Step 11

Course aggregates and fine aggregates

15%	20mm	277 kg/m ³
20%	12mm	370 kg/m ³
35%	6mm	647 kg/m ³
30%	fine sand	554 kg/m ³

Step 12

$$\begin{aligned}\text{Super plasticizer 2.5\% of mass of fly ash} &= 424.62 \times 0.025 \\ &= 10.62 \text{ kg/m}^3\end{aligned}$$

IV. EXPERIMENTAL RESULTS

The test has been completed to focus the behaviour and mechanical properties of fly ash with bagasse ash in geopolymer concrete and fly ash with rice husk ash in geopolymer concrete in rate of 10%, 30%, 50% of fly ash volume. This part incorporates the test work, properties of material, concrete mix and testing of specimen.

To achieve the point of present study the experimental work is done on 24 quantities of fly ash - bagasse ash geopolymer concrete cubes and 24 quantities of fly ash-rice husk ash geopolymer concrete cubes for compressive strength test, 24 quantities of fly ash-bagasse ash geopolymer concrete cylinders and 24 quantities of fly ash-bagasse ash geopolymer concrete barrel for split elasticity test and 24 quantities of fly ash-bagasse ash geopolymer concrete beams and 24 quantities of fly ash-rice husk ash geopolymer concrete beams for flexural strength test, where the measurement of cubes are (150x150x150)mm, cylinders are 300mm height and 150mm diameter and the beams are (500x100x100)mm of sizes. The replacement of bagasse ash and rice husk ash is done in rates of 10%, 30%, 50% of fly ash volume.

Compressive Strength Test Results

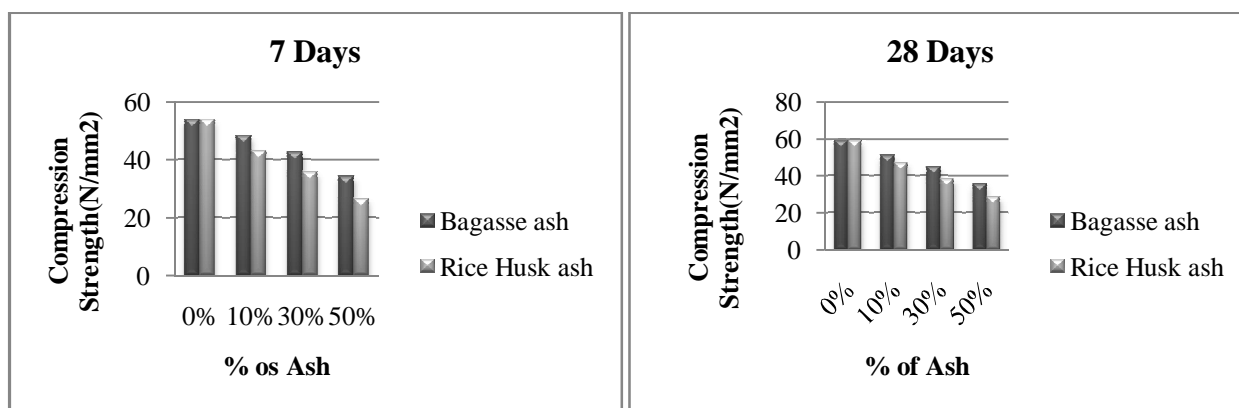
From the result tabulated beneath shows that compressive strength of the fly ash-bagasse ash geopolymer concrete and fly ash-rice husk ash geopolymer concrete both gets decreased as the percentage of the bagasse ash or the rice husk ash is increased in the rate of 10%, 30%, 50% of fly ash volume. At the point when looked at both kind of concrete, increase of bagasse ash with fly ash demonstrates the preferred result over the increase of rice husk ash with fly ash for all i.e., 10%, 30%, 50% of replacement.

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Tests Results For Compression Strength (N/mm ²)				
% Of Ash	7 Days		28 Days	
	Bagasse ash	Rice Husk ash	Bagasse ash	Rice Husk ash
0	53.93	53.93	59.03	59.03
10	48.37	43.17	52.20	46.94
30	42.66	35.77	44.93	38.30
50	34.17	26.40	35.60	28.50



Split Tensile Strength Test Results

The cylindrical moulds of size 300mm height and 150mm diameter are used to focus the behaviour of fly ash with bagasse ash in geopolymer concrete and fly ash with rice husk ash in geopolymer concrete.

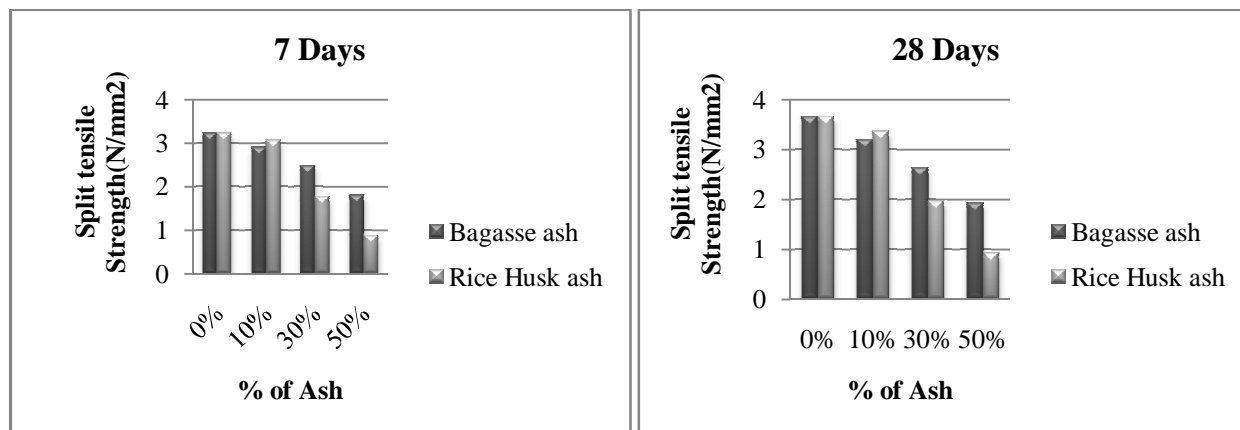
From the table underneath it is observed that there is a gradual decrease in the split tensile as the percentage of the bagasse ash is incorporated with the fly ash in the rate of 10%, 30%, 50% where in the case of rice husk ash for the 10% replacement of fly ash the split tensile strength is reduced little bit however there is a sudden reduction with the addition of rice husk ash in the percentages of 30 and 50 of fly ash volume. At the point when compared about both sort of geopolymer concrete, for replacement of 10% of fly ash with rice husk ash gives the better result than the replacement of fly ash with bagasse ash. If we consider for 30% and 50% the replacement of fly ash with bagasse ash shows better results than the replacement of fly ash with rice husk ash.

Test Results For Split Tensile Strength (N/mm ²)				
% of Ash	7 Days		28 Days	
	Bagasse ash	Rice Husk ash	Bagasse ash	Rice Husk ash
0	3.23	3.23	3.66	3.66
10	2.90	3.07	3.20	3.36
30	2.47	1.77	2.63	1.97
50	1.80	0.87	1.93	0.93

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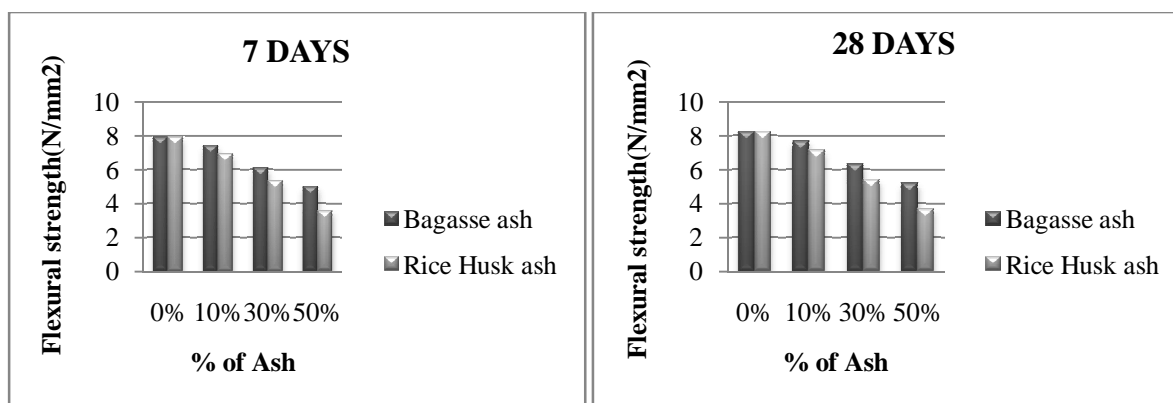
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Flexural Strength Test Results

The prismatic beam of size (500x100x100)mm was used to determine the horizontal stress of fly ash-bagasse ash geopolymer concrete and fly ash-rice husk ash geopolymer concrete. From the table beneath it shows that as the percentage of bagasse ash or the rice husk ash with replacement of fly ash is increased the flexural strength of geopolymer concrete gets. When both type of geopolymer concrete is compared the fly ash-bagasse geopolymer concrete produces better results then fly ash-rice husk ash geopolymer concrete in addition of all percentages with the replacement of fly ash.

Test Results For Flexural Strength (N/mm ²)				
% of Ash	7 Days		28 Days	
	Bagasse ash	Rice Husk ash	Bagasse ash	Rice Husk ash
0	7.92	7.92	8.25	8.25
10	7.42	6.92	7.67	7.16
30	6.08	5.33	6.33	5.42
50	5.00	3.58	5.17	3.66



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V. CONCLUSION

- Higher the percentage replacement of bagasse ash or rice husk ash there will be a decrease in compression, tension and flexural strength of geopolymer concrete.
- With 10% replacement of ashes, the replacement with bagasse ash is better than the rice husk ash for both compression and flexural strength. But for split tensile strength replacement with rice husk ash is better than the bagasse ash.
- For 30% and 50% replacement of ashes, the replacement with bagasse ash is better than rice husk ash for all i.e., compression, split tensile and also the flexural strength.
- Geopolymer concrete with the replacement of bagasse ash or rice husk ash up to 10% that is the optimum percentage can be utilized. One of any can be used depending on the availability possibility, if both are of same possibility or having equivalent accessibility chances than continuing for the replacement of bagasse ash is better than the rice husk ash.
- With replacement of 30% to 50% of rice husk ash the strength gradually decreases for compression where as for the split tensile and the flexural strength properties there is a sudden decrease in strength which should be restricted being used.
- The utilization of geopolymer concrete should be possible in the dry places where the portable water is costlier which must be used in the stage of curing of OPC, but on account of geopolymer concrete curing is done through heat which gives around 85% strength within 7 days therefore the expense can be minimize and furthermore the work can be made faster because of its initial strength characteristics.

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BIOGRAPHY



Tony Suman Kanth D is a P.G.Student, Dept. of Structural Engineering, Brindavan college of Engineering, Dwarkanagar, Bangalore, India