A REVIEW PAPER ON OPTIMIZING THE STRENGTH OF RIGID PAVEMENT BY USE OF CLASS F FLY ASH IN GEOPOLYMER CONCRETE BY COCONUT FIBER ASH

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Abstract : Geopolymers are a type of inorganic polymer & light weight material that can be formed at room temperature with less energy losses by using industrial waste or by-products as source materials to form a solid binder. Geopolymer concrete is manufactured from utilization of waste material from industrial waste such as fly ash. Geopolymer concrete is a type of by which we can be used in applications to fully or partially replace OPC with environmental and technical alternative to Ordinary Portland Cement (OPC) based concrete. In the manufacture industry the creation of Portland cement causes the secretion of air pollutants which results in environmental contamination. It reduces 80 - 90% CO2 emissions. Coconuts fiber is collected from temples & shops and it is burn in open air then the ash obtained by coconut fiber ash is passed through 150 micron sieve. And then replacement of class f fly ash by coconut fiber fly ash from 0%, to 25 %. The color of fly ash may vary from tan to dark grey, depending upon the chemical and mineral constituents. The other characteristics of fly ash which are benefits, & its main aim to reduce carbon dioxide up to 80-90% and improved resistance to fire, impermeable and aggressive chemicals. Fly ash plays a vital role in Geopolymer concrete, and class f fly ash is used in construction purposes which contain 10% of lime also to replace the use of conventional ordinary Portland cement. To activate the substance in fly ash, sodium hydroxide solution and sodium silicate solution was used in combination.

***IndexTerms*- geopolymer, Coconut fiber, fly ash, sodium hydroxide.**

I. INTRODUCTION

Concrete is the mostly used man made material in the world after water. It is attain by incorporation cementing materials, sand, aggregates, and sometimes admixtures within require proportions. The mixture of these materials when placed in moulds and allowed to cure hardens into the rock like mass known as Concrete. The OPC is the main ingredient for the manufacturing of Ordinary Portland Cement Concrete. Replacement of low calcium fly ash with ash of coconut fiber is done.
The requirement of concrete is increased as the demand for infrastructure development is increased. The exploitation of cement pollutes the environment and produces raw resources in the manufacturing of Ordinary Portland Cement (OPC), it also requires large quantities of fuel for burning as well as the decomposition of limestone, resulting in considerable emissions of CO2. Cement plants have been emitting up to 1.5 billion tons of CO2 into the atmosphere annually. Upto80- 90% of carbon is emitted from cement so GPC is a substitution to cement. Geopolymer Concrete is the solution for this problem and has been introduced to reduce this problem. Geopolymer concrete is an inert polymer concrete that can be easily formed at standard room temperature by using industrial waste or by-products as foundation materials to form a solid mass and it is looks like OPC and performs similar function to OPC.

Geopolymer concrete is a type of concrete that is made by reacting aluminates and silicate bearing materials with a alkaline activator. Commonly, waste materials such as fly ash or slag from iron and metal production are used, which helps lead to a cleaner environment which is necessary to prevent hadrons environment. This is because the waste material is actually decomposed within the concrete itself and it also does not have to be liable of as it is being used. Geopolymer concrete does not require any heat or fuel to compose it and does not produce any amount of carbon dioxide. Standard Portland cement based concrete requires both heat and as well as also released carbon dioxide.

PROPERTIES OF GEOPOLYMER CONCRETE:-

- Harmless.
- Do not necessitate an extra temperature to harden.
- It is Impermeable and do not permits any expanse of water to pass through it.
- Higher conflict to hotness and repel to all inert solvents.
- As compared to other grades the strength is more.
- Light in mass and density.

RESTRICTIONS OF GEOPOLYMER CONCRETE

The limitations of GPC are as follows: -

i) Taking the ignoble substantial fly ash to the essential location.
ii) High rate for the alkaline solution (sodium silicate, sodium hydroxide).

iii) Protection hazard connected with the high alkalinity of the galvanizing solution.
iv) Practical difficulties occur for applying vapour curing / high hotness curing process.

CLASSIFICATION OF FLY ASH

• **Class F or Siliceous Fly Ash or Low calcium Fly Ash: -** Coal grade are of numerous types but theFly ash which we acquire from bituminous and anthracite coals is referred as ASTM Class F fly ash or low calcium fly ash.

• **Class C or Calcareous Fly Ash or High calcium Fly Ash: -** Fly ash which we obtain from peat and lignite blazing and is a sort of sub-bituminous coals is referred as ASTM Class C fly ash. It contains more than 20 percent of fly ash

II. OBJECTIVES

The main object of the study is:-

i) To investigate on consequence of Molarity Additive Activator on Power of Geopolymer Concrete (GPC) by substituting class f fly ash by ash of cocunut fiber
ii) To trial the engineering properties.
iii) To utilize the unused constituents vacant in the agro-industries.
iv) To reduce the discharge of $Co2$ caused due to manufacturing of cement.
v) To study the engineering properties of fresh and hardened Geopolymer Concrete.

III. METHODOLOGY

Stage-1:- Literature Survey: - In this various literature papers have been studied after which the final best research work was selected.
Stage-2:- Materials to be used: - The materials which are to be used in the research is selected.
Stage-3:- Concrete Mix Design: -After the selection of materials M30 grade concrete mix design is done.
Stage-4:- Laboratory work: - Testing materials and method of geo-polymer concrete for determination of various parameters.
Stage-5:- Data analysis and presentation: -Analyse the results of various tests conducted and convert it in tabular form.
Stage-6:- Conclusion and recommendation: - After analysis and presentation we conclude the results.

IV. LITERATURE REVIEW

Peresia Blapoh Wungko (2017) Examining Concrete Properties using Coconut Fiber Ash and Fly Ash as Partial Replacement for Cement studies that Concrete is a composition of cement, coarse aggregate, fine aggregate and water which makes it a composite material. Fly ash which is a waste material is used as a supplementary cementitious material in the production of Portland cement and when added to concrete, it gives good workability, greater strength, decreases permeability and increases durability. Coconut fiber is an agricultural waste which can be burned into ash and when added to concrete as a partial replacement of cement, it has great potentials. The aim of this project work is to investigate concrete properties using coconut fiber ash and fly ash as partial replacement for cement in regards to the compressive strength which is investigated for 3,7, 28,56 and 90 days.
It is observed that partially replacing cement with at most 20% of coconut fiber ash without the addition of fly ash yields a better compressive strength of 29 N/mm2 at 28 days and 38.21N/mm2 at 90 days From the investigation, it can be noted that, by the addition of 20% coconut fiber ash and 10% fly ash as a partial replacement for cement yields a high compressive strength because at a curing date of 28 days, the compressive strength was found to be 22.09N/mm2 and 42.92N/mm2 at 90 days.

Sanjay Kumar Ahirwar (2017) EXPERIMENTAL STUDY ON CONCRETE USING FLY ASH AND COCONUT COIR FIBER Fine Fly ash can be used as a binding material in concrete in the place of cement because fly ash is having Pozzolana property. The workability test, compressive and tensile strength tests were examined from the previous research papers at 7th, 14th and 28th day of curing. 5% and 10% replacement of cement with fly ash gives better result and by replacing 15% of fly ash the strength decreases. Then for improving tensile strength of concrete for 5% and 10% replacement of fly ash with cement is performed by adding coconut coir natural fibre of length 6mm and 12mm with quantity of 0.15% and 0.25% by weight of cement for M20 grade of concrete.

Sanjay Sen, Rajeev Chandak, Effect of coconut fibre ash on strength properties of concrete,(2015) In this case coconut fibre ash, which is an environmental pollutant. Coconut fibres are collected and the fibre are properly dried and burnt in the open air with a temperature range of 6000 c to 7000 c. when the fibres turned into ash. The ash was collected and made to pass through 150 micron sieve. This work presents the results of laboratory test carried out using coconut fibre ash (CFA) as a partial replacement for cement in concrete production. Concrete cubes are cast and tested at curing aging of 7, 28, 60, & 90 days using 0, 5, 10, 15, 20, &25 percent replacement levels. The slump test results show that the workability of the concrete decreased as the CFA content increased & the compressive strength of CFA concrete increased with curing aging but decrease with increasing the percentage of coconut fibre ash. The percentage strength gained at 90 days for 5% and 10% for the control of 0% is 96.22% & 86.12% respectively. The optimum compressive strength of 59.25N/mm2 was obtained at 5% replacement at 90 days of ages. The percentage strength at this optimum point of the control is 96.22%.

V. MATERIALS TO BE USED

- **Fly Ash: -** For experimental work **class f** or **siliceous fly ash** or **low calcium fly ash** is used.

Fig. 1 Fly Ash

- **Coconut Fiber Ash: -** Coconut fiber, also known as coir, originates from the innermost covering of coconuts. Coconut fiber ash is the by-product after the coir or fiber has been scrupulously burnt.

Fig. 2 Coconut Fiber Ash

- **Coarse and Fine Aggregates: -** We have taken 10mm and 20mm Sizes of coarse aggregate for the experiment. Nearby available stream sand, which is obtained from Narmada River, having a lower size of about 0.07mm was used as a fine aggregate in concrete.
- **Alkaline Solution: -** A combination of sodium hydroxide solution and sodium silicate solution was selected as the alkaline activator, to activate the inactive material flyash.

Fig. 3 Sodium Hydroxide

Fig. 4 Sodium Silicate

VI. TESTS TO BE PERFORMED

- **Compressive Strength Test: -** Lift the specimen from laboratory floor or outside after specified age and wipe out any dirt from the surface. Place the sample in the machine in such a way that the load must be applied to the conflicting sides of the cube cast. Line up the specimen centrally on the bottom plate of the machine. Rotate the variable portion smoothly by hand so that it touches the top face of the specimen. Apply the load slowly and steadily without shock and continuously at the rate of 140kg/cm2/minute till the specimen or cube fails. Note the highest load and it should also be noted that any unusual features in the type of failure must not occur.

Compressive strength in N/mm^2= Maximum load at failure in N
Average area of the bed faces in mm^2

- **Slump Cone Test: -** In this test the workability of the mix is determined with the help of conical mould of upper dia. 10cm, lower dia. 20cm & height 30 cm. First of all the concrete is prepared and it is filled in 4 layers into the mould. Each layer was tamped 25 times.Excess concrete was removed from the mould and surface was level with help of trowel. Raise the mould with the help of hand and note the difference in height of the mould and the specimen.
  The slump (Vertical settlement) measured shall be recorded in terms of millimeters of subsidence of the specimen during the test.

- **Flexural Strength Test: -** Test specimens stored in water at a temperature of 27+2°C for 48 hours before Testing. The dimensions without shock and increasing continuously at a rate such that the extreme fibre stress increases at approximately 7 kg/mm2. The load shall be increased until the concrete fails, and the maximum load applied to the brick during the test shall be recorded.of each specimen shall be noted before testing. Place the Specimen in UTM. The axis of the specimen shall be carefully aligned with the loading device. The load shall be applied

Flexural strength (N/mm2) =Maximum load at failure (N) x Length of brick
* Width of brick in mm x depth of brick in mm

- **Splitting Tensile Test :-** Casted specimen should be stored in a place at a temperature of 27° +/- 2°C for 24 +/- 0.5 hrs. from the time addition of water to the dry ingredients.After that, the sample should be marked and removed from the mould and instantaneously submerged in clean fresh water or drenched lime solution and kept there until taken out just earlier to the test.The water or solution in which the specimens are retained should be rehabilitated every seven days and should be sustained at a temperature of 27° +/- 2°c.For design purpose, the specimen cured for 28 days.Then, wipe out water from the surface of sample.After that, draw diametrical lines on the two ends of the specimen to confirm that they are on the similar axial place.Next, record the weight and measurement of the sample. Set the compression testing machine for the mandatory range.Place plywood stripe on the lower plate and place the specimen.Place the other plywood strip above the sample. Bring down the upper plate so that it just touches the plywood strip.Apply the load uninterruptedly without shock at a rate within the range 0.7 to 1.4 MPa/min (1.2 to 2.4 MPa/min based on IS 5816 1999) finally, note down the infringement load (P).At last, for each analysis, three sample shall be casted and tested. Then, the average tensile strength will be occupied.
  Calculate the splitting tensile strength of the specimen as follows:
  $T= 2P/ \pi LD$
  T = splitting tensile strength, MPa
  P: maximum applied load indicated by the testing machine, N
  D: diameter of the specimen, mm
  L: length of the specimen, mm

VII. CONCLUSION

- Curing can be done in two format i.e. an in ambient curing and oven drying curing, we have done oven drying curing at 60^o C.
- Coconut fiber should have good durability and abrasion resistance characteristics.
- High lignin content as it has high resistance to different weather and therefore coconut fiber is suitable material for construction of road.
- Molarity also affects the viscosity. The viscosity increases with the increase in molarity.
- The coconut fiber is used as a fuel but after burning the ash it is of no use, so we are utilizing the same ash.
- Coconut fiber ash does not require very high temperature for its production. As cement requires very high temperature for its production which pollutes the environment.
- As we have done cost analysis of the GPC which is compared with the normal OPC concrete in which the cost reduction is observed if we are using GPC which means that using GPC is economical as compared to normal OPC.

VIII. REFERENCES

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