Investigate Lime Added Geopolymer Concrte With Different NDT's

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Abstract- *In this project we discus about geopolymer concrete is a type of concrete that is made by reacting sodium hydroxide and sodium silicate materials with a caustic activator. Commonly, waste materials such as process and unprocessed fly ash are used, which helps lead to a cleaner environment. The comparisons between processes fly ash and unprocessed fly ash by adding lime for strength and durability of geopolymer concrete and this find out by NDT's. In oven curing for geopolymer concrete could form cracks due to possibility of shrinkage and the percentage of voids in geopolymer concrete may have lower value so it can achieve maximum compressive strength.*

Portland cement is important ingredient in conventional concrete. Approximately one ton of carbon dioxide emitted in atmosphere for production of one tonne cement. Industrial waste - fly ash used for making geopolymer concrete. Fly ash is produced from industrial waste and easily available around the world. Minimum percentage of fly ash is effectively used and remaining part of it is disposed in landfills. Geopolymer concrete is cost effective and eco-friendly for use. In today's time, this technology is being used widely in the USA, Europe and Australia. It is being used for railway sleepers, electric power poles, road pavements, cement mortar, Marine structures and Waste containments. In current research is focuses on a user-friendly geopolymer concrete. Use of geopolymer concrete increase the economy in construction and less harmful to the environment. it has large scope in replacement of cement.

Keywords- Process fly ash, unprocessed fly ash, hydrated lime, sodium silicate, sodium hydroxide.

I. INTRODUCTION

The concrete industry challenges the issues to meet the growing demand of Portland cement due to limited sources of limestone, slow manufacturing growth and increasing carbon taxes. It is reported that the requirement of cement in India is likely to touch 560 million tonnes by 2020 with a shortfall of 220 million tonnes and the demand for cement has been constantly increasing due to increased infra-structural activities of the country.

In recent years, geopolymer has attracted considerable attention because of its early compressive strength, low permeability, good chemical resistance and good resistance to fire. Due to these properties, the geopolymer is used as an alternative to ordinary cement for developing in various building materials, concrete, fire resistant coatings, fibre reinforced composites and waste immobilization solutions for the chemical and nuclear industries.

Geopolymers are the reaction of a solid aluminosilicate powder and alkali hydroxide/alkali silicate.
Geopolymer concrete has been introduced to reduce the environmental effects. It is also showing good properties such as high compressive strength, low creep, good acid resistance and low shrinkage.

Fly ash is industrial waste which is discarded in enormous amounts every year. The global annual ash production is 500 million a tonne by mass 75%-80% of which is composed of fly ash. These large quantities of fly ash aggravate the problem of landfills saturation worldwide.

II. RESEARCH OBJECTIVES

- To study the various property of geopolymer concrete.
- To find out strength differences between processes and unprocessed fly ash.
- To find out shrinkage and creep in geopolymer concrete.
- Identification of factors influencing mechanical properties and durability.
- Investigation of process and unprocessed fly ash their reactivity with alkaline.
- To study the rheological characteristics with natural curing.

III. MATERIAL

SODIUM SILICATE

Sodium silicates are colourless glassy or crystalline solids, or white powders. The main applications of sodium silicates are in production of detergents, paper, water treatment, and construction materials.

3.1.2 SODIUM HYDROXIDE

Sodium hydroxide is a highly caustic base and alkali in nature that decomposes proteins at ordinary ambient temperatures and may cause severe chemical burns. It's highly soluble in water, and casually absorbs moisture and carbon dioxide from the air. Sodium hydroxide is a highly calorific base and alkali that decomposes proteins at general ambient temperatures and may cause severe chemical burns. It's highly soluble in water.

3.1.3 FINE AGGREGATE

In our investigation we had used the sand confirming the zone III according to IS-383.Specific gravity of sand was found out to be 2.68.

3.1.4 COURSE AGGREGATE

The coarse aggregate is strongest and porous component of concrete. Presence of coarse aggregate reduces the drying shrinkage and other dimensional damage occurring in moisture. In our investigation we had used the aggregate passing through 20mm IS-Sieve and retaining on 12.5mm sieve. The specific gravity of aggregate was found out to be 2.71.

3.1.5 FLY ASH

Fly ash is a coal oxidation product. It is also known as powdered fuel ash. Fly ash is a by-product of coal-fired electric power plants. quartz, feldspar, clay and shale, fuse in are the mineral impurities of coal. Fly ash is widely used as a substitute for Portland cement in the industry. When added to concrete, fly ash improves strength, ease of pumping of concrete and segregation. These advantages of fly ash over Portland cement make it a preferred material for construction activities. Fly ash is used widely in the construction industry in developed countries. However, lack of global awareness about the benefits of using fly ash as construction material is hampering the fly ash industry. Increase in demand for fly ash in bricks & blocks applications and extensive usage of fly ash in road construction are some of the key factors driving the fly ash industry. The fly ash can be classified into Type F and Type C. Type F is the most commonly used fly ash due to its excessive usage in mass concrete and high strength mixes.

IV. EXPERIMENTAL STUDY

Concrete mix design

The mix design for M35 grade of concrete with target strength 43.25 Mpa used for this study.

The proportions of material are given below in table.

TABLE 1. CONCRETE MIX DESIGN

Item in mix	**Specific gravity (g/cc)**	**weight(kg/m^3)**
NaOH	2.13	81.6
Na_2SiO_3	1.40	122.4
Natural sand	2.68	567.13
Coarse Aggregate	2.71	1216.88
Fly Ash	2.16	510
Lime	2.24	51

V. RESULTS AND DISCUSSION

A) workability

We take trial and error test on flow table test an and select the Solution to Fly ash ratio 0.40.

B) NDT test (Rebound hammer test)

From the result it observed that solution to fly ash ratio and molarity increases strength also increases.

The following values are based on the testing on concrete block made by using various molarity and solution ratio. Each value is taken from the average of 3 specimens of each molarity and solution ratio.

TABLE 4. STRENGTH OF CONCRETE DIFFERENT MOLARITY AND SOLUTION TO FLY ASH RATIO

MOLARITY	Solution ratio ($NaOH/Na_2SiO_3$)	AVG. STRENGTH	
		PROCESS FLY ASH	UNPROCESS FLY ASH
10	1.5	42.65	37.35
	2.0	44.62	38.00
	2.5	46.24	39.90
13	1.5	43.47	37.77
	2.0	45.14	38.14
	2.5	46.58	40.00
16	1.5	43.96	38.02
	2.0	45.68	39.56
	2.5	46.75	41.09

VI. CONCLUSION

A) If we increase solution to fly ratio strength also increase.

B) Increasing solution to fly ash ratio cost also increases.

C) The strength achieved by Natural curing method with added 10% hydrated lime.

D) Increasing solution to fly ash ratio workability also increases.

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