International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 12 | Dec 2022 www.irjet.net p-ISSN: 2395-0072

Study on Temperature Effect and Molar Concentration Parameter for Green Concrete

Dr.Y.Shantharam[1]

[1]Associate Professor
Department of Civil Engineering
Mahendra Engineering College, Namakkal, Tamilnadu, India

Abstract - *Efforts are required to provide environmentally friendly construction materials in order to reduce greenhouse gas emissions. The manufacturing of Portland cement (pc) is being closely examined since a significant amount of carbon dioxide gas is being discharged into the atmosphere. Due to the expanding need for infrastructure development, As a result, there is an urgent need for careful attention and to minimize their impact on the sustainability of our living environment. One tone of carbon dioxide is released into the atmosphere for every tone of Portland cement during the decarbonation of limestone in the kiln during cement production. The cementitious by-products like GGBFS, RHA & FA are utilized as a alternate binder with different molar concentration and various temperature effects. The compressive strength was increased with increase in molar concentration and also with temperature effect.*

Key Words: (Size 10 & Bold) Green Concrete, GGBFS, RHS FA, Molar Concentration, Temperature Effect.

1. INTRODUCTION

The manufacturing of Portland cement (pc) is being closely examined since a significant amount of carbon dioxide gas is being discharged into the atmosphere. As a result, efforts to use rice husk ash in place of some of the portland cement in concrete are gaining traction. Geopolymer concrete, on the other hand, is a "new" substance that does not require portland cement to act as a binder because, in industrial by products having the equivalent to cement binders[1-4] i.e., the silica and alumina present in the industrial by-products like GGBFS, RHA & FA. This products should be reacted with catalytic liquid solution like sodium silicate and sodium hydroxide.

1.1 EXPERIMEMENTAL PROGRAMME

The tests involve mixing the necessary amounts of flyash and GGBFs, reacting them with an alkaline liquid solution of NaoH and Na2SiO3, then curing the casted cubes in a hot air oven at a regulated temperature.

1.2 Materials Used

Fly ASH

For this experimental study, low calcium fly ash, or Class C fly ash, which has higher silica and calcium content, is used. For the geopolymerization reaction, the product should have higher silica and alumina content.in cambria font. Type 3 fonts must not be used. Other font types may be used if needed for special purposes.

Fig-1: Fly ash

GGBFS

Because the GGBFS is also rich in silica and alumina content, which is the higher responsibility for the geopolymerization reaction; it is chosen for this project.

RHA

The RHS is the residue from the rice mill, which is used as a firewood to boil the raw paddy, the burnt ash is called RHA this is rich in silica and alumina which can be used a the green binders in the concrete.

In this experimental effort, fine aggregate from a natural river was employed, and it was examined in accordance with IS: 2386.1970. Sand utilised has a fineness modulus of 2.81 and a specific gravity of 2.7.

For the current experiment, coarse aggregate made of crushed granite with angular particles was utilised. 2.83 is the specific gravity, and fineness.

2. HIREARCHY OF THE RESEACH WORK

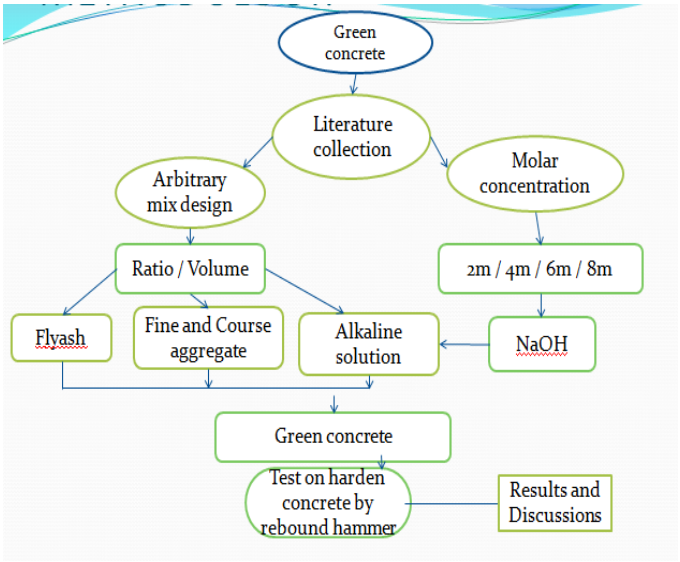

Fig-2: Research Methodology.

The flow chart shows that the green concrete is manufactured by the arbitrary mix design concept, from that the materials quanity is arrived and the molar concentration is prepared for the various percentage, and mixced with the dry materials and the concrete is manufactured.

2.1 Arbitrary Mix Design

In the arbitrary mix design concept, the density of concrete is assumed from that the volume / weight ratio the individual materials are arrived including the sodium hydroxide and sodium silicate materials.

Alkaline liquid-to-fly ash & GGBFS ratio	Sodium silicate solution-to-sodium hydroxide	Mass of alkaline liquid solution Kg/m^3
0.35	2.5	144
0.40	3.0	146
0.45	3.5	158
0.50	4.0	165
0.55	4.5	178
0.60	5.0	186
0.65	5.5	192

Table -1: Mass Alkaline Liquid solution

3. CONCRETE MADE FROM GEOPOLYMERS

3.1 Catalytic Liquid Solution Development

The reaction of the geopolymer concrete is depends on the catalytic liquid solution (CLS), the reaction start working with silica and alumina elements present in the industrial by-products like fly ash, GGBFS and RHA.

The sodium hydroxide used for this project is pellets form and tyhe sodium silicate is in liquid state.

The sodium hydroxide solution is mixed with the sodium silicate solution and at the necessary molar concentrations, 24 hours before casting of the cubes.

3.2Amounts of Molar

The molar concentration is the percentage of the sodium hydroxide dissolved in the water, higher the percentage concentration the strength will be increased. The molar concentration is determined by using the molecular weight of the sodium hydroxide with the times of the dimesionloess number

The sodium hydroxide solution's molar concentration is its concentration after it has been mixed with distilled water; for instance, sodium hydroxide has molar concentrations of 4,8,16, and 32. it is computed by multiplying by the sodium hydroxide's molecular weight.

The 360 grams of sodium hydroxide should be dissolved in 1 litre of distilled water to create a solution with a 4 molar concentration since 4 molar concentration = 40 X 4 = 360. The molar concentration ranges from 4M to 32M in this experimental investigation to evaluate the compression strength of concrete at various molar concentrations.

Fig-3: Various molar concentration prepared in various jars.

Fig-4: Molar Concentration Preparation

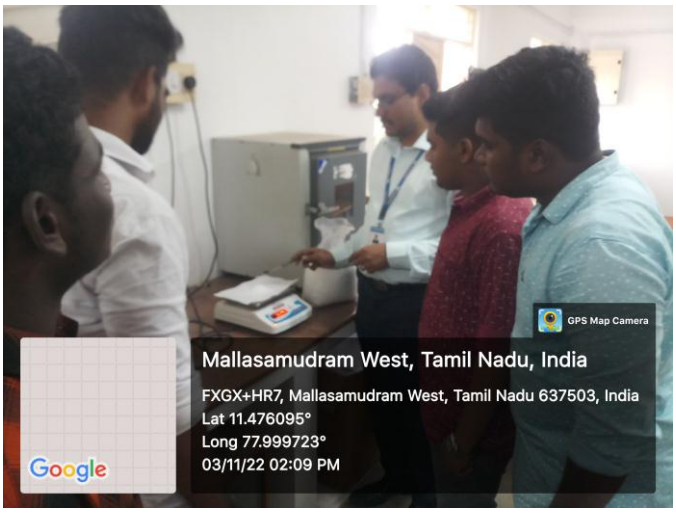

Fig-5: Weighing of Sodiuum Hydroxide with appropriate Molar Concentration

3.3Specimen Castings

Fly ash and GGBFS are well blended in the dry mix for 2 to 3 minutes, followed by the addition of fine and coarse aggregate. The catalytic liquid solution is made up of sodium hydroxide and sodium silicate solution, which have been combined earlier than 24 hours. The green concrete is then moulded into cubes of 150 X 150 X 150 mm in size.

Fig-6: Specimen Preparation

3.4 Hot Air Oven Curing

The curing for the Green concrete is done by hot air oven curing, by this method the curing is accomplished and the green concrete attains the strength by geopolymerization reaction[6]. The Specimen is placed in the hot air oven for various timings and temperature effects and the cube is tested for compressive strength. The temperature is the main factor for the reaction, when the temperature increases the geopolymerization reaction will increased and the concrete reaches the early strength, the time factor will also influence the strength of concrete, the time increases i.e the period in which the concrete kept inside the hot air oven the strength factor will increased.

Table -1: Effect of Molar Concentration

ALKALINE FLY ASH RATIO	MOLAR CONCENTARTION	COMPRESSIVE STRENGTH kN/²
0.30	2	16
0.35	4	18
0.40	8	21
0.45	10	22
0.50	12	25
0.55	14	24
0.60	16	25
0.65	18	28

Table -2: Effect of Temperature Variation

ALKALINE FLY ASH RATIO	TEMPERATURE Period in HRS	COMPRESSIVE STRENGTH kN/m²
0.30	2	10
0.35	4	16
0.40	8	18
0.45	1	18
0.50	12	21
0.55	14	26
0.60	16	26
0.65	18	27

Table -3: Effect of Temperature Variation

4. Results and Discussion

The research shows that the temperature variation and molar concentration increases the compressive strength of the concrete increased the molar concentration started frem 2M to 18M the strength increased significantly, similarly for the temperature effect started from 2 hours to 18 hours the strength consistently increased. The higher compressive strength attains in the molar concentration parameter is 28kN/mm² for 18M and for temperature variations, the period of 18hrs considered to be maximum strength of 27kN/m².

5. CONCLUSION

The research reveals that the green concrete shows good results with increase in temperature as well as increase n time period. The research work limited up to the alkaline flyash ratio up to the 0.65 and the period of 18 hrs the concrete attains the 27kN/m values beyond that the value to be tested and examined that there will be significant changes in the strength. The The final results show that, the minimum time the concrete attains the higher strength and the concrete to be considered as the green concrete by reducing the emission of carbon-di-oxide to the environment. The green concrete is highly versatile and it will be considered as eco-friendly material.

REFERENCES

[1] Gourley.T.J Geopolymers: Opportunities for Environmentally Friendly Construction Materials" Adaptive Materials for a modern society, Sydney 2003.

[2] Gartner E, Industrially Interesting Approaches to 'Low-CO2 Cements "Cement and Concrete research, 34(9) 2004, pp.1489-1498.

[3] McCaffery R Climate Change and the Cement Industry, Global Cement and Lime Magazine (Environmental special issue), 2002 pp15-19

[4] Surya Prakash A, Senthil Kumar.G Experimemntal Study on Geopolymer Concrete Using steel fibres, International Journal of Engineering Trends and Technology 21(8) 369-399.

[5] Tarun Gehlot, and Sankhla .S.S Study of Concrete Quality Assessment of Structural Elements Using Rebound Hammer Test, American Journal of Engineering Research 5(8) pp 192-198.

[6] Shatharam Y, A Novel Approach on Fly Ash And GGBFS Based Green Concrete By Adopting the Non Destructive Test to Study their Strength Parameters, Journal of Emerging Technologies and Innovative Research 6(6)pp 209-213