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Experimental Investigation Of High Strenghth And Ecofriendly Geopolymer Cubes

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Abstract

Conservation of natural resources and preservation of environment is very necessary thing. Rapid growth of industry has resulted the generation of huge quantity of wastes, both in solid and liquid in industrial sectors. It's presumed that about 10-15% of wastes produced are hazardous and generation of hazardous wastes is increasing at the rate of 2-5% per year. These generated waste were dumped on land or discharged into water bodies and thus becomes a large source of environment pollution and health hazards. This paper presents the information about utilization of industrial wastes as a suitable material for construction purposes, by which cost of construction can be reduced and also a safe disposal of waste materials can be achieved. In the present study cement will be partially substituted by GGBS (10%, 20%, and 30% and so on) and fine aggregates will be partially replaced by copper slag 20% ,40%,60%so on. The strength parameters such as compressive strength will be confirmed for both 14 days and 28 days of curing period. Based on it the test appropriate results will be derived.

Keyword:– GGBS, copper slag, compressive strength.

I. INTRODUCTION

The amount and type of generated waste has grown with increasing world popuation. Concrete is the second most consumed material after water, it requires large quantities of Portland cement. The manufacturing process of ordinary Portland cement results in destruction of the environment due to the CO2 emission as well mining also results in unrecoverable loss to nature and ecosystem . The amount of carbon emissions is increasing on an alarming scale due to use of concrete and hence, it is required to find an alternative material to the existing expensive cement-concrete. Concrete is a mix combination of cement, fine aggregate, coarse aggregate, water. And sand is the chief raw material

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used as fine aggregate in the manufacturing of concrete. The normal sources of river sand are getting exhausted rapidly. The response for the guard of the natural environment and the ban on mining in some zones is further creating the problem of availability of river sand for construction. At present day, the construction industry is afflicted with the insufficiency of this essential component material of concrete.The construction industry recognizes that substantial improvements are essential in production, product concert, energy efficiency and environmental performance. The industry has to face and prevail over a number of institutional, competitive and technological challenges. One of the major challenges with the environmental consciousness and shortage of space for land-filling is the waste by-products consumption as an alternative to discarding. All the way through the engineering sector, including the concrete production, the cost of environmental fulfillment is more. Use of industrial by-product such as foundry sand, fly ash, industry ash and slag can answer in significant improvement largely in industry energy efficiency and environmental presentation.

Types of Geopolymer materials are as follows:

1. *Copper slag*
2. *Ground Granulated Blast Furnace Slag (GGBS)*
3. *Sodium Silicate*
4. *Fly ash*
5. *Wire mesh*

II. DIFFERNT FACTORS

A. Copper Slag: Copper slag is an industrial by-product material produced from the method of producing copper. It's been discovered that approximately 24.6 million tons many slag is generated from the globe copper industry. Even though copper slag is widely empoyed within the sand blasting industry and within manufacturing of abrasive tools, the remainder slag is disposed of with none further reuse or reclamation. Copper slag has mechanical and chemical characteristics due to which the fabric can be used in concrete as a partial replacement for cement or as a substitute for fine aggregates. For instance copper slag contains a number of favorable mechanical properties for fine aggregate use like excellent soundness characteristics, good abrasion resistance and good stability. Copper slag also shows pozzolanic properties since it contains low CaO. Under activation with NaOH, it would exhibit cementations property and may be used as partial or full replacement for cement. the use of copper slag for applications like cement replacement in concrete, or as stuff has the twin advantage of eliminating the price of disposal and lowering the price of the concrete. the utilization of copper slag within the concrete industry as a replacement for cement can have the advantage of reducing the prices of disposal and help in protecting the environment. Despite the actual fact that several studies are reported on the effect of copper slag replacement on the properties of Concrete, further investigations are necessary so as to get a comprehensive understanding that will provide an engineering base to permit the utilization of copper slag in concrete. Use of copper slag as areplacement matrial in concrete industry elps to achieve economy and protecting the environment.

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Fig:1.1 Copper slag

B.Ground Granulated Blast-furnace Slag (GGBS):

It's a by-product from the blast-furnaces recycled to create iron. Blast furnaces are nourished with precise mixture of iron-ore, coke also limestone, and worked at a temperature of about 1,500°C. When iron-ore, coke and limestone melt in the blast furnace, two yields are formed—molten iron, and molten slag shown in fig 1.2. The molten slag is lighter and floats on the top of the liquefied iron. The molten slag contains silicates and alumina from the unique iron ore. The procedure of refining the slag includes cooling of molten slag through pressured water jets. This quickly extinguishes the slag and customs granular particles generally not greater than 5 mm. The speedy cooling inhibits the formation of larger crystals, and the causing granular material comprises around 95% noncrystalline calcium-alumino silicates. The granulated slag is further processed by drying and then grinding in a vertical roller mill or rotating ball mill to a very fine powder, which is GGBS. Although normally designated as "GGBS" in the UK, it can similarly be mentioned to as "GGBS" or "Slag cement".

Fig:1.2 GGBS

C .Sodium Silicate:

The other name for sodium silicate is liquid glass or water glass,

available in liquid form. In the present report sodium silicate 2.0 (ratio between

Na2O to SiO2) is used. Manufacturer gave the information that silicates were supplied to the

detergent company and textile industry as bonding agent. Sodium silicate is used to

further making of geopolymer concrete.

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Fig:1.3 Sodium Silicate

D. Fly Ash:

Fly ash is the inorganic material residue after burning of coal/lignite in the boilers. Fly ash is a portion of ash which can be collected from the bottom portion of the boilers. The characteristics of fly ash depends upon the quality of lignite/coal and the efficiency of boilers. India depends upon preliminary coal for the requirement of power and the power generation is likely to go up from 60,000Mw in the year 2010. The generation of fly ash is also likely to increases. The disposal of fly ash in the present method will be a big challenge to environment, especially when the quantum increase from the present level.

Fig:1.4 Fly Ash

E.Wire Mesh:

½ inch square wire mesh is one of the reinforcing material used in fabrication. It is generally used in ferrocement technology.

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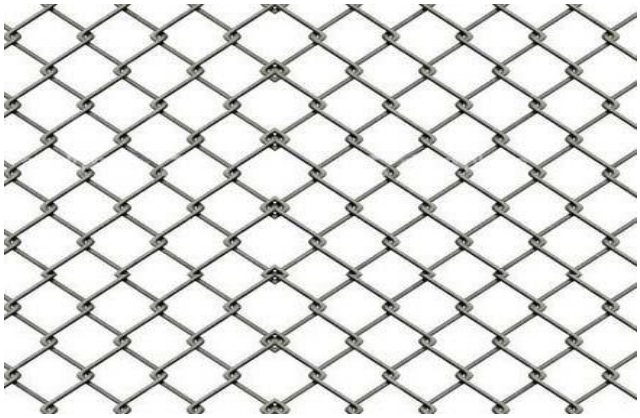

Fig:1.5Wire Mesh

III. APPLICATIONS

A. To cast geopolymer cubes by using geopolymer material.
B. To check the compression strength of cubes using Universal Testing Machine (UTM).
C. To compare the strength of concrete cube with geopolymer cube.
D. To prepare cost analysis and comprising geopolymer cubes and concrete cubes.

IV. SAMPLE PROJECT

Name of the Project:Experimental Investigation Of high strength And Ecofriendly geopolymer Cubes

V. RESULT

A.Test and test result

1.Compressive strength:

SR.NO	% OF GGBS & COPPER SLAG REPLACEMENT	SAMPLES	14 DAYS STRENGHT (N/MM)	AVARAGE 14 DAYS STRNGHT	28 DAYS STRENGHT (N/MM)	AVARAGE 28 DAYS STRNGHT
1	0%	-	28.48	-	41.18	-
2	20 &2O %	SAMPLE 1	15.11	18.19	25.2	29.27
		SAMPLE 2	22.18		32.11	

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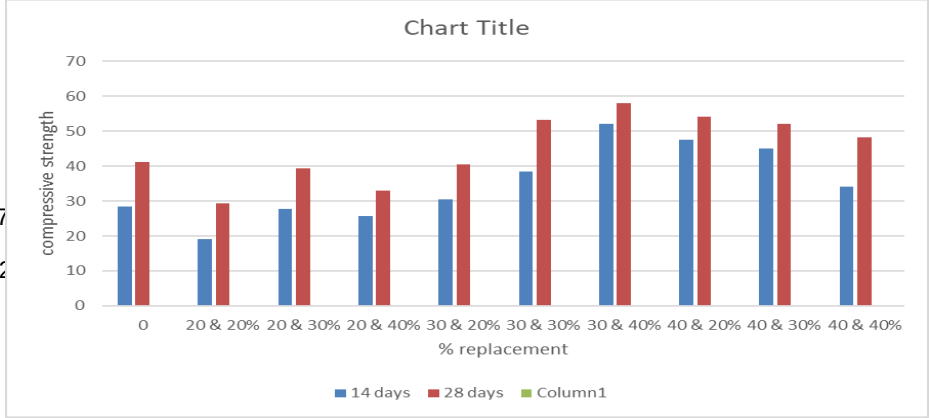
		SAMPLE 3	19.68		30.5	
3	20 & 30 %	SAMPLE 1	30.2	27.83	38.51	39.34
		SAMPLE 2	26.1		39.42	
		SAMPLE 3	27.2		40.1	
4	20 & 40 %	SAMPLE 1	26.1	25.6	32.1	32.87
		SAMPLE 2	24.2		35.2	
		SAMPLE 3	26.5		31.33	
5	30 & 20 %	SAMPLE 1	32.24	30.51	42.1	40.53
		SAMPLE 2	30.1		40.0	
		SAMPLE 3	29.2		39.5	

The compression strength of 6 cubes tested for 14 days and 28 days. 100 KN capacity UTM was used to measure the compressive strength of concrete. Compressive strength was measure for 14and 28 days.

Compressive Strength For Control Mix Trial



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6	30 &3O %	SAMPLE 1	46.1	48.46	51.23	53.12
		SAMPLE 2	50.1		58.23	
		SAMPLE 3	49.2		49.9	
7	30 & 40 %	SAMPLE 1	56.3	51.98	60.12	57.51
		SAMPLE 2	50.25		58.4	
		SAMPLE 3	49.4		55.23	
8	40 & 20 %	SAMPLE 1	44.9	47.56	62.3	54.2
		SAMPLE 2	52.7		50.1	
		SAMPLE 3	45.14		50.2	
9	40 & 30 %	SAMPLE 1	36.8	45.1	56.6	52.02
		SAMPLE 2	47.3		48.14	
		SAMPLE 3	51.2		51.3	
10	40 & 40 %	SAMPLE 1	30.2	34.27	46.49	48.23
		SAMPLE 2	35.33		50.2	
		SAMPLE 3	37.1		48.1	

VI. CONCLUSIONS

A. The compressive strength of concrete with partial replacement of sand by copper slag by 40% and cement by GGBS can be replace by 30% has achieved 57.91 higher of 28 days when compare with control mix.

B. The compressive strength of concrete for partial replacement of fine agg with copper salg by 40% and cement with GGBS by 30% has increased byb16.73% when compared with conventional concrete.

C. The cost of geopolymer cubes is very less as compared to conventional blocks i.e geopolymer blocks are economical.

D. Water absorption for optimal mix (0.25) is less when compared with conventional concrete.

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