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An Experimental Study on Utilization of Waste Materials & Eco–Friendly Construction to Make Green Concrete of Grade M25

Urvashi[1], Er. Punita Thakur[2], Er. Jainender Sharma[3]

[1]M.Tech Scholar, Civil Engineering, Sri Sai University
[2,3]Assitant Prof. Civil Engineering, Sri Sai University

Abstract - *A Green concrete is a game-changing concept in the concrete industry's history. In the year 1998, this was initially invented in Denmark. Color has nothing to do with green concrete. It's a way of thinking about the environment when it comes to concrete, from raw materials to mixture design to structural design, construction, and service life. To some extent, conventional concrete is accountable for carbon dioxide emissions. Green concrete is a novel technology that was created recently to lessen the environmental impact of cement manufacture. Cement contains a high amount of carbon-dioxide, which has a significant negative impact on the environment; therefore, by replacing cement with various materials that have a negative impact on the environment, we not only reduce the problem of disposal of these materials, but we also reduce the emission of carbon-dioxide from cement, thereby reducing the negative impact on the environment..*

Key Words: **Silica fume, Fly ash, Rice husk ash, , Recycled Aggregates, super plasticizer(nepthalene formaldehyde forsoc).**

1.INTRODUCTION

Green concrete refers to concrete that is created from environmentally beneficial concrete debris. Green concrete refers to concrete that is made using as many recycled resources as feasible while leaving the minimum carbon footprint possible. Green concrete is also known as resource-saving constructions that have a lower environmental impact, such as energy savings, CO2 emissions, and waste water. Green concrete is frequently thought to be inexpensive to make due to the use of recycled resources, which eliminates trash disposal fees, reduces energy usage, and increases durability. Cement production accounts for more than 6% of total CO2 emissions, making it a significant contributor to global warming (greenhouse gas). India is the most populous country on the planet. As a result, green concrete plays a critical role in reducing the environmental impact. We can reduce CO2 emissions from concrete as well as the environmental impact on the earth by employing recycled materials or waste products that are hazardous to the environment as a replacement for cement, such as fly ash, silica fume, and so on. As a result, when natural resources are on the edge of extinction, green concrete will be one of the most important tools.

I.

1.1 LITERATURE REVIEW

A.P. Gursel et al. (June 15, 2015)[4] This study looked at the strength, durability, elastic modulus, and environmental impact of several "green" concrete mixes using fly ash with and without RHA. When compared to a standard 100 percent PC concrete mixture, the "green" alternative produced lower GWP and criterion air pollutants.

Neeraj Agarwal (July 2018)[10] Due to the massive amounts of cement and concrete generated in this article, the absolute statistics for the environmental impact are extremely high. Because concrete is the second most consumed substance after water, it accounts for about 5% of global CO2 emissions. We can securely replace cement with glass up to 30 percent and a bit more, but not 45 percent or more. We can substitute cement with (glass + fly ash) up to 30% of the time, but not 45 percent or higher. The 28-day strength of (glass + fly ash) is greater than the 28-day strength of glass replacement.

Vishvanath kanthe et al. (July, 2018)[11] The combined effect of fly ash (FA) and rice husk ash (RHA) on concrete characteristics as a partial replacement for standard Portland cement is the subject of this research report (OPC). The pozzolanic reactivity of these by-products is high. In this study, 10% RHA was employed in conjunction with 10%, 20%, and 30% FA as a partial replacement for cement in the mix.

Mohammed Ibrahim et al. (December 20, 2018)[13] the chemical constitutes of precursor materials, the composition and concentration of alkaline activators, volume of free water, and curing conditions are some of the mix design variables that influence the fresh and hardened properties of alkali-activated binders. To achieve desirable engineering properties and long-term performance of an AAB under various exposure conditions, each of these variables has to be carefully controlled.

1.2 EXPERIMENTAL WORK

Methodology

To achieve the objectives of the work various experiments are performed are:

1. Compressive Strength Test for Concrete

2. Split Tensile Strength Test for Concrete

3. Flexural Strength Test for Concrete

Materials

The following materials were used for preparing the concrete mix.

Acc Cement Of 53 Grade.

1. Fine Aggregate I.E. Sand
2. Coarse Aggregate (Recycled)
3. Fly Ash
4. Silica Fume
5. Rice Husk Ash
6. Super Plasticizer
7. Water

Fly Ash : Fly ash is a byproduct of combustion that is made up of fine particles that rise with the flue gases. Bottom ash refers to ash that does not rise. Fly ash is the ash produced by the burning of coal in an industrial setting. Fly ash is a substance that is heterogeneous in nature. Particles are normally spherical in shape and range in size from 0.5u to 300um when they solidify.

Fig. 1 Fly Ash

Silica Fume: Silica fume is a fine non-crystalline silica formed as a byproduct of the manufacturing of elemental silicon or silicon alloys in electric arc furnaces. (Source: ACI CT). The average particle size of silica fume is around 100 times smaller than that of Portland cement. Silica fume is available in both wet and dry forms for usage in concrete.

Fig. 2 Silica Fume

Rice Husk Ash: Rice husk ash is a type of agricultural waste that accounts for almost a tenth of the world's yearly rice production of 649.7 million tonnes. Rice husk ash has been successfully employed as a pozzolana in industrial production in a variety of locations, including Asian countries. Burning the husk at a regulated temperature below 8000C produces ash containing silicon oxide, mostly in the amorphous form.

Fig. 3 Rice Husk Ash

2. RESULTS AND DISCUSSIONS

Mix	Average compressive strength of concrete after various curing ages in n/mm²	
	7 Days	28 days
M_0	16.33	24.68
M_1	17.05	23.75
M_2	19.32	27.23
M_3	20.31	28.48
M_4	20.33	28.2
M_5	21.53	29.22
M_6	22.18	30.06
M_7	22.51	31.29
M_8	22.4	31.31
M_9	23.39	33.15
M_{10}	23.21	33.97
M_{11}	22.51	31.15
M_{12}	22.6	31.44
M_{13}	22.38	30.43

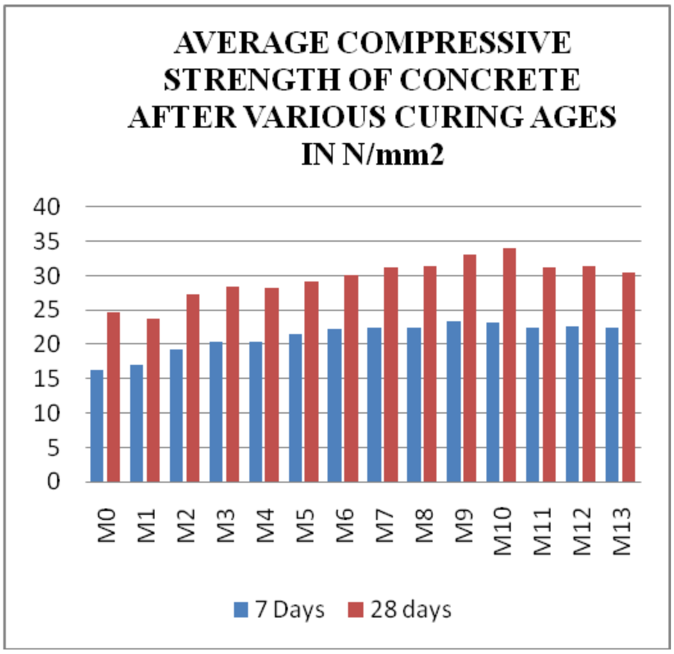

CHART 2.1: Bars Chart of Compressive Strength of Concrete

Mix	Average Split Strength of concrete after various curing ages in N/mm²	
	7Days	28Days
M_0	2.73	3.74
M_1	2.9	3.8
M_2	3.07	4
M_3	2.98	3.77
M_4	3.02	3.53
M_5	2.98	3.98
M_6	3.1	3.87
M_7	3.1	3.97
M_8	3.05	4.13
M_9	3.15	4.32
M_{10}	3.17	4.47
M_{11}	3.25	4.13
M_{12}	3.13	4.17
M_{13}	3.02	4

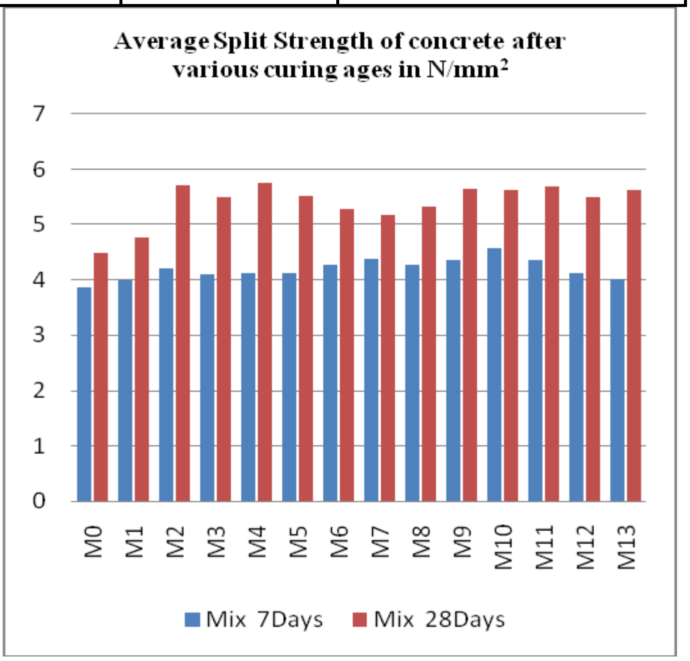

CHART 2.2 : BAR CHART OF SPLIT TENSILE STRENGTH OF CONCRETE

Mix	Average Flexural Strength of concrete after various curing ages in N/mm²	
	7Days	28Days
M_0	3.87	4.48
M_1	4	4.77
M_2	4.2	5.72

M_3	4.1	5.49
M_4	4.13	5.75
M_5	4.13	5.52
M_6	4.28	5.28
M_7	4.37	5.17
M_8	4.28	5.32
M_9	4.35	5.65
M_{10}	4.57	5.63
M_{11}	4.35	5.7
M_{12}	4.13	5.5
M_{13}	4.02	5.62

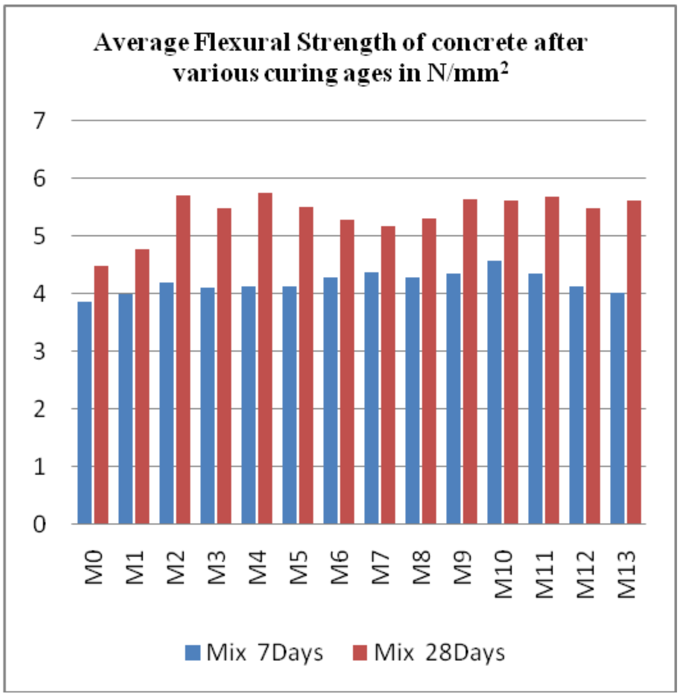

CHART 2.3: BAR CHART OF FLEXURAL STRENGTH OF CONCRETE

3. CONCLUSIONS

1. CO_2 emissions are reduced by up to 30%.

2. Experiments demonstrate that fly ash, rice husk ash, and silica fume could be utilised as partial replacements in the manufacturing of concrete.

3. Increased the usage of waste products in the concrete industry by 20%.

4. Reduces structure's dead weight and crane age load.

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BIOGRAPHIES

URVASHI, pursuing M.tech in Structural Engineering, and B.tech in Civil Engineering from Sri Sai University Palampur, (H.P.) India.

Er. Jainender Sharma is an H.O.D at Sri Sai University Palampur (H.P.) India's Department of Civil Engineering.
He has around 15 papers in international and national journals and conferences to his credit. Material, Concrete, and Special Concrete are his research interests.

Punita Thakur is an Assistant Professor at Sri Sai University Palampur (H.P.) India's Department of Civil Engineering.
She has over five papers published in international and national publications and conferences. Material, Concrete, and Special Concrete are his research interests.