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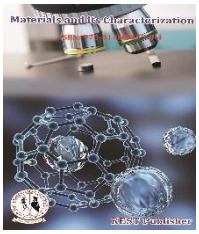

Experimental Investigation on Mechanical and Physical Properties of Green Concrete Based onGGBSand Bagasse Ash

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Abstract:*Green concrete is a sustainable and eco-friendly solution as a building material. The conventional concrete release huge volume of carbon dioxide which leads to the environmental pollution. In green concrete cement partially replaced with by-products of industrial production process of other materials or recycled waste. This study investigates the mechanical and physical properties of green concrete based on the partial replacement of cement with ground granulated blast furnace slag (GGBS) and fine aggregates with bagasse ash. A series of trial mixes were conducted to determine the optimal mix design for the green concrete, and a sufficient number of samples were prepared and tested for various properties, including compressive strength, tensile strength, flexural strength, water absorption, and porosity. The results indicate that the green concrete containing GGBS and bagasse ash as partial replacements for cement and fine aggregates, respectively, exhibited comparable or even higher compressive strength than traditional concrete. The green concrete also exhibited lower water absorption and porosity, indicating improved durability. The findings suggest that green concrete based on GGBS and bagasse ash has significant potential as a sustainable building material.*

Keywords:*Green Concrete, Bagasse Ash, Ground Granulated Blast Furnace Slag.*

1. INTRODUCTION

Concrete is the most widely used building material in the world, but its production is associated with significant environmental impacts. Traditional concrete production requires large amounts of natural resources, including cement, aggregates, and water, and generates significant carbon dioxide emissions during production. As the construction industry continues to grow, there is an increasing need for more sustainable building materials that can reduce the environmental impact of construction. Green concrete is a sustainable alternative to traditional concrete that utilizes recycled materials and waste products, reducing the demand for natural resources and minimizing the carbon footprint of construction. The use of industrial by-products, such as ground granulated blast furnace slag (GGBS), and agricultural waste, such as bagasse ash, as partial replacements for cement and fine aggregates, respectively, has shown promise in producing green concrete with comparable or even improved properties compared to traditional concrete. This study aims to investigate the mechanical and physical properties of green concrete based on the partial replacement of cement with GGBS and fine aggregates with bagasse ash. The research will focus on determining the optimal mix design for the green concrete, as well as evaluating its compressive strength, tensile strength, flexural strength, water absorption, and porosity. The study will compare the properties of the green concrete with those of traditional concrete and evaluate the potential environmental and economic benefits of using green concrete. The findings of this research are expected to contribute to the development of sustainable building materials and provide valuable insights into the use of GGBS and bagasse ash in green concrete production. Ultimately, the research aims to promote more sustainable practices in the construction industry and reduce its environmental impact.

2. MATERIALS AND METHODS

In this experiment sand used is building sand with a specific gravity of 2.58. Bore well water was used for all mixtures. The materials used in this project were Portland Cement (PC), Ground Granulated Blast Furnace Slag

(GGBS) and bagasse ash. The cement was replaced partially with GGBS and bagasse ash. 30, 25, 20, and 10% of GGBS replaced along with 10, 15, 20 , 30 of bagasse ash. Compressive strength testing was conducted to determine the performance of the green concrete. The compressive strength tests will be conducted using a compression testing machine. The samples were prepared for 150mm x 150mm x 150mm in size for each mixing proportion and the test was carried out after 7, 14 and 28 days of curing. Obtained data from the tests were determine the effect of varying the percentage of GGBS and bagasse ash on the properties of the green concrete, which compared with traditional concrete in terms of compressive strength. The control cube prepared with traditional concrete samples and tested using the same methods as the green concrete samples.

3. RESULT AND CONCLUSION

The compressive strength test result for the below combinations of Portland Cement (control), GGBS and bagasse ash were carried out.

TABLE 1. Compressive strength test

S.No	Sample ID	Portland Cement (%)	GGBS (%)	Bagasse ash (%)
1	Control	100	0	0
2	GC001	60	30	10
3	GC002	60	25	15
4	GC003	60	20	20
5	GC004	60	10	30

Compressive strength test has been carried out at 7, 14 and 28 days of curing which plot in Figure 1.

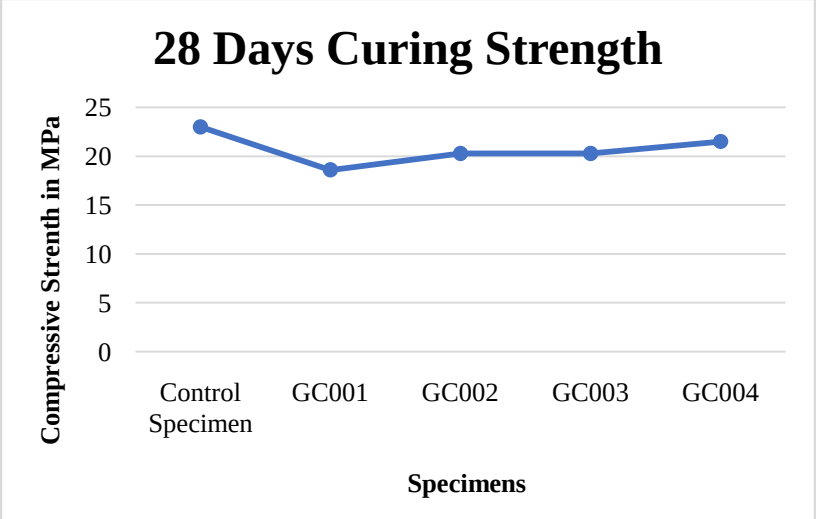

FIGURE 1. Characteristics Compressive Strength of Concrete

From Figure 1 that increase in the period of curing resulted in improved compressive strength for all the mixtures. At 7 days of curing, the results show that increasing the GGBS and Bagasse ash in the mixture, the compressive strength was decreased. It indicates that property of the GGBS and Bagasse may react with cement compounds very slowly during initial days. Similarly, GC001, GC002, GC003 and GC004 comparatively less compressive strength than control mix during the initial day curing. After day 14, experiment showed higher compressive strength of the cement mortars contain GGBS and Bagasse, which indicate GGBS and Bagasse improves concrete property. The results shows after 28 days of curing GC001 specimen achieved higher compressive strength than others specimen and control specimen. Comparatively 5% increment achieved than control specimen which also higher than GC002, GC003 and GC004 such 23%, 16% and 11 % respectively.

4. CONCLUSION

Green concrete is a sustainable and eco-friendly solution as a building material. The conventional concrete release huge volume of carbon dioxide which leads to the environmental pollution. In green concrete cement partially replaced with by-products of industrial production process of other materials or recycled waste. Concrete is the most widely used building material in the world, but its production is associated with significant environmental impacts.

Traditional concrete production requires large amounts of natural resources, including cement, aggregates, and water, and generates significant carbon dioxide emissions during production. As the construction industry continues to grow, there is an increasing need for more sustainable building materials that can reduce the environmental impact of construction.In this experiment sand used is building sand with a specific gravity of 2.58. Bore well water was used for all mixtures. The materials used in this project were Portland Cement (PC), Ground Granulated Blast Furnace Slag (GGBS) and bagasse ash. The cement was replaced partially with GGBS and bagasse ash. 30, 25, 20, and 10% of GGBS replaced along with 10, 15, 20 , 30 of bagasse ash. Compressive strength testing was conducted to determine the performance of the green concrete. The compressive strength tests will be conducted using a compression testing machine.

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