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A Comparative Experimental Investigation of the Compressive Strengths of Marble Dust and Wood Dust

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ABSTRACT: The compressive strength of marble dust and wood ash were both obtained comparatively, these materials were obtained from Kota town, Rajasthan, India. The materials were replaced by 30% by weight, results were obtained from Career Point University Laboratory, the compressive strength of Marble Dust Concrete was found to be 8.62 N/mm² with a figure difference of about 0.06 N/mm² and then wood dust Concrete was found to be 7.82 N/mm² after 7 days of curing. This showed a corresponding decrease in the values obtained from the experiment by implication, wood ash has less compressive strength compared to marble dust ash.

KEYWORDS: Comparative, Experimental, Investigation, Compressive Strength, Marble Dust, Wood Dust.

I. INTRODUCTION

Compressive Strength of strength of engineering materials is unarguably one of the most significant engineering characteristics of different types of concrete. Not minding the material that is been used, whether conventional or any of the new materials been introduced in concrete technology in recent years, the importance of compressive strength cannot be overemphasized. The standard for which Concrete is been categorized is primarily based on the compressive strength of the concrete, this is the standard that is employed in industrial settings to obtain concrete grades. This practice is used for both concrete cubes and cylinders, however the former was used in the course of this experiment with 150mm size as per Indian Standard, the universal testing machine was used in the experiments. Compressive Strength can thus be simply defined as the ability of concrete to withstand or resist compression which is load that attempts to push it together. For Purposes of design however, the compressive strength figure or value is constrained through dividing the value obtained by a safety factor, the value thus, is dependent on the philosophy of design that is used.

II. AIM

The research is aimed at investigating the compressive strength of Marble dust and wood dust using universal testing Machine (UTM).

III. OBJECTIVES

The objectives of the research are;

1. To investigate the compressive strength of Marble dust and wood Husk.
2. To check the suitability of both marble dust and wood husk for specific construction works.
3. To check the economic advantage of partially replacing these materials with grade 33 cement according to Indian Standards (IS).

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IV. MATERIALS

The materials used in the research work include but not limited to Marble dust, wood husk, Universal Testing Machine(UTM), Calliper, lubricant, water, cement, sand and coarse aggregates of average sizes.

V. METHODOLOGY

The materials used in this research work were obtained in the various industries were the materials are by-products, marble dusts were gotten from the popular Kota stones as wastes products, while the wood husk which is a by-product of cutting, crushing, boring, polishing of wood was obtained from a wood industry in Kota town of Rajasthan in large quantities enough for the research work.

These materials were mixed with ordinary Portland cement 33 grade according to IS 269, in the Concrete laboratory of Career Point University Kota, the results obtained are shared in this article. The various materials were cured for 7days and crushed after.



Fig 1.1 Wood Husk Ash.



Fig. 1.2 Marble chip (Pulverized to dust)



Fig. 1.3 Lubricated Standard Cube



Fig. 1.4 Pouring and tempering of concrete.

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Fig.1.6 Wood Husk concrete under compression.



FIG.1.7 Marble Dust Ash Concrete under compression.

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Table 1.0 Physical and chemical properties of marble dust.

Physical and chemical characteristics of the marble.

Physico-mechanical properties	White Fil-Fila marble
True density (g/cm ³)	2.736
Bulk density (kg/cm ³)	2.684
Porosity (%)	1.96
Absorption (by weight) (%)	0.39
Saturation (%)	0.87
Compressive strength (dry state) (MPa)	94.3
Compressive strength (after cooling and reheating) (MPa)	94.8
Wear resistance (mm)	1.82
Impact resistance (cm)	40
<i>Chemical characteristics</i>	
CaCO ₃	99.05
MgO	1.03
CaO	54.86
Fe ₂ O ₃	0.04
Al ₂ O ₃	0.08
SiO ₂	0.15
P.C	44.26

Source; H. Hebhouh et al (2010)

Table 1.1 Composition of Wood Ash.

Constituents	Wood Ash (%)
SiO ₂	31.8
Al ₂ O ₃	28
Fe ₂ O ₃	2.34
CaO	10.53
MgO	9.32
SO ₃	-
Na ₂ O	6.5
K ₂ O	10.38

Source: Francisco Grau et al (2015)

VI. RESULTS AND DISCUSSION

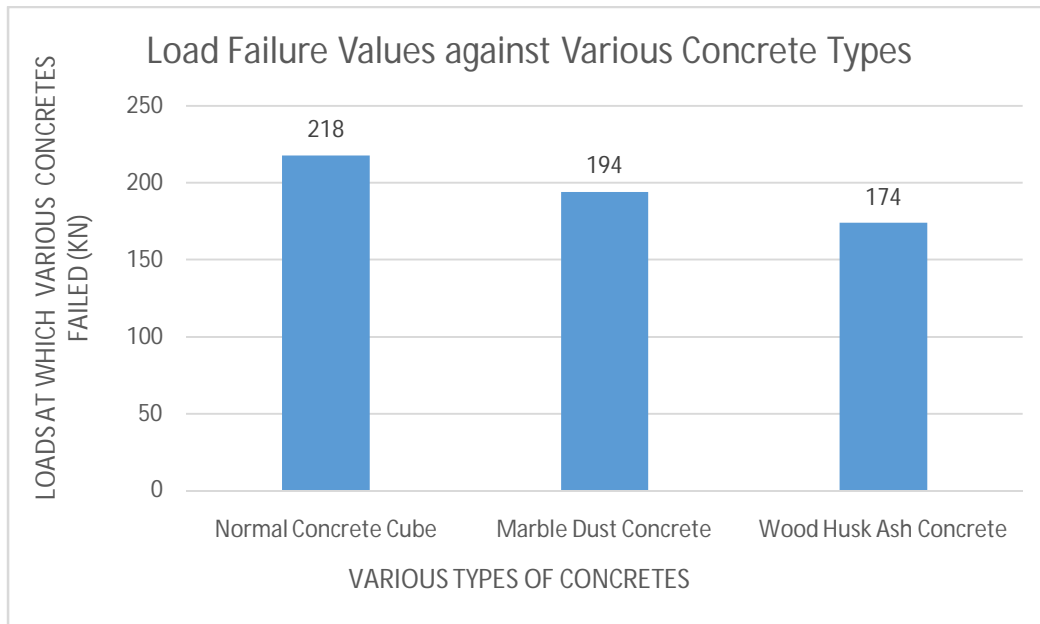
As observed in the figure below, the normal concrete had a higher value at failure as compared to the both Marble Dust and Wood Husk Ash concrete, this signifies that the strength in compression of the normal concrete which was of Grade 33 according Indian Standard has higher Compressive Strength than the resulting replacement of both Marble dust concrete and Wood ash concrete. There is a significant difference in the values of load failure. While the normal Concrete failed at 218KN, Marble dust Concrete failed at 194KN then Wood Husk Ash failed at 174 KN. The percentage difference between normal concrete and Marble dust concrete is seen to be 11% while that of Marble dust concrete and Wood Husk Ash Concrete is 9% approximately.

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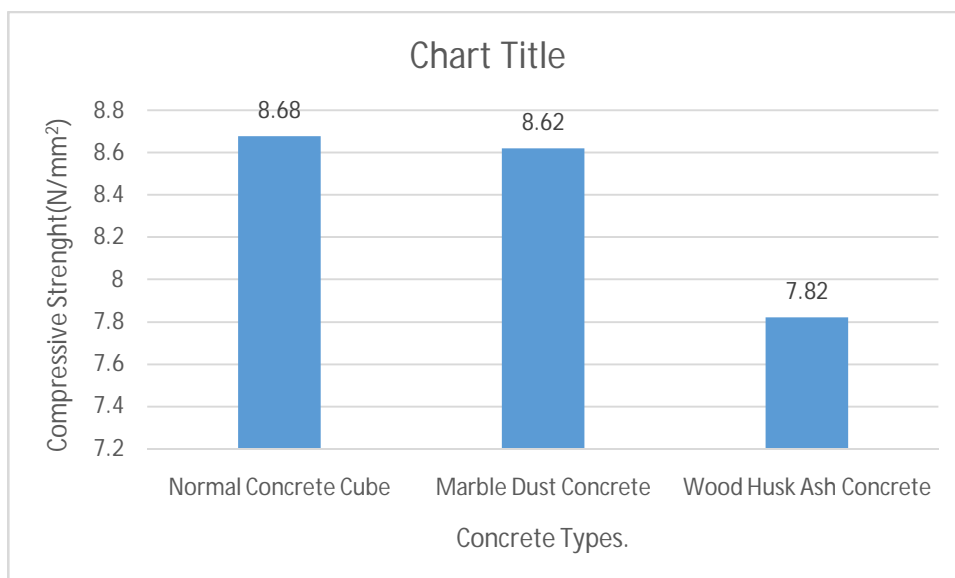
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As seen in the results displayed in the bar chart below, the result shows clearly that the compressive strength of normal Concrete is significantly higher than that of both Marble Dust concrete and wood Ash concrete, this shows that Normal concrete may hardly be replaced with the two materials used in experimenting, to an extent even replacing partially may yield little or no positive results. While the Compressive Strength of normal Concrete was at 8.68 N/mm^2 , that of Marble Dust Concrete was found to be 8.62 N/mm^2 with a figure difference of about 0.06 N/mm^2 and then wood husk Ash Concrete was found to be 7.82 N/mm^2 , this showed a corresponding decrease in the values obtained from the experiment.



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VII. CONCLUSION

It is imperative to mention that the experimental investigation shows that the partial replacement of concrete with the above-named materials stands to produce low results. However, marble dust concrete performed much more better than wood husk ash Concrete. Thus, Marble dust concrete has higher Compressive strength than wood husk ash concrete and can perform better in construction works where weak concrete may be needed. Though may be used to produce weak concrete for purposes that are meant for weak concrete such as production of mortar for construction and also the filling of block cavity when necessary.

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