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presentation



African School of Fundamental
Physics and Applications



UNIVERSITY OF
RWANDA

COLLEGE OF SCIENCE & TECHNOLOGY

School of sciences
Physics department

Mechanical properties and durability of cement based material processed with granite sawing powder waste.

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This report is summarized under five chapters,

- Introductory part,
- The review of the literature,
- Methodology,
- Results and discussion, and
- Conclusion & recommendation

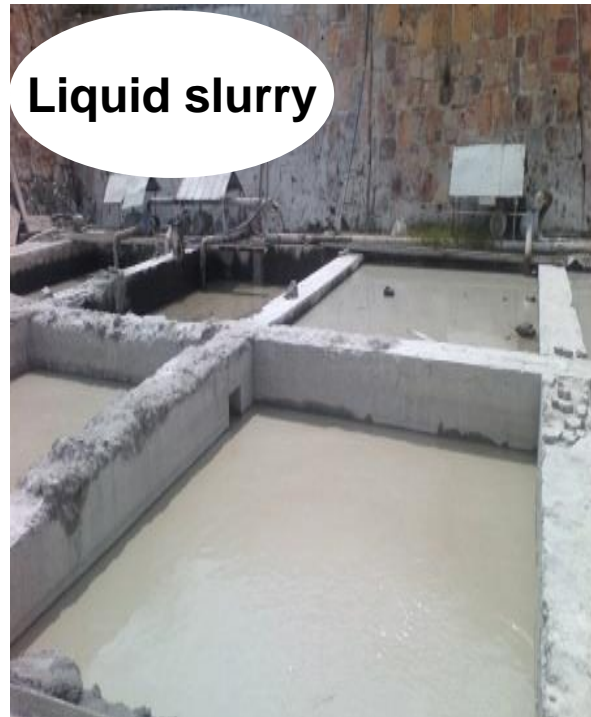
1. Introduction

- Concrete is a cement based material which has been a leading since 19th century in building industry.
- Etymology of concrete: “**concretus**” (meaning compact or condensed), the perfect passive participle of “**concrecere**” from “con” (together) and “**crescere**” (to grow).
- The importance of concrete in modern society cannot be overestimated. About **3.8 m³** annual global production.



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- Recently researches confirmed the efficiency of using marble stone waste and mineral waste in concrete manufacturing.
- Granite stone industry generates different types of waste including solid waste and stone slurry which are environmental and human life hazard.



1.1 Problem statement

- The land disposal wastes are non-environmental friendly.
- Environment need to be sustainable conserved against granite industries production waste.
- Cement manufacturing processes are among greenhouse gas contributors in global environment.
- The current global consumption of natural river sand is very high due to its extensive use of concrete.
- Construction industry need durable materials with improved mechanical characteristics.

A photographic view of research problem statement



The land disposal waste of powdered granite



1.2 Objectives

❖ **Main objective:** To investigate the effect of using granite sawing powder wastes as either admixture or partial replacement of cement and/or natural river sand on mechanical properties and durability of concrete materials.

❖ **Specific objective:**

✓ To evaluate the mechanical properties of fresh and solid concrete blocks.

✓ To establish the optimal application of granite sawing powder in concrete processing.

✓ To assess the effect of granite sawing powder on the concrete resistance to water penetration.

1.3 Significance of this study

- Government of Rwanda will get an alternative method that should come out as response for sustainable environment in order to achieve the sustainable development goals (SDGs) where protection of environment considered (especially 11th, 12th, 13th and 15th).
- This study provide guidelines of using granite sawing powder in concrete manufacturing, construction industry will have durable concrete at low cost,
- Granite industries will boost their economy, by selling their production waste even if is at minimal cost.

1.4 Research hypothesis

To produce concrete with 25Mpa in compressive strength at 28days curing blended with granite powdered wastes used as either admixture or partial replacement of cement and/or natural river sand.

2 Methodology

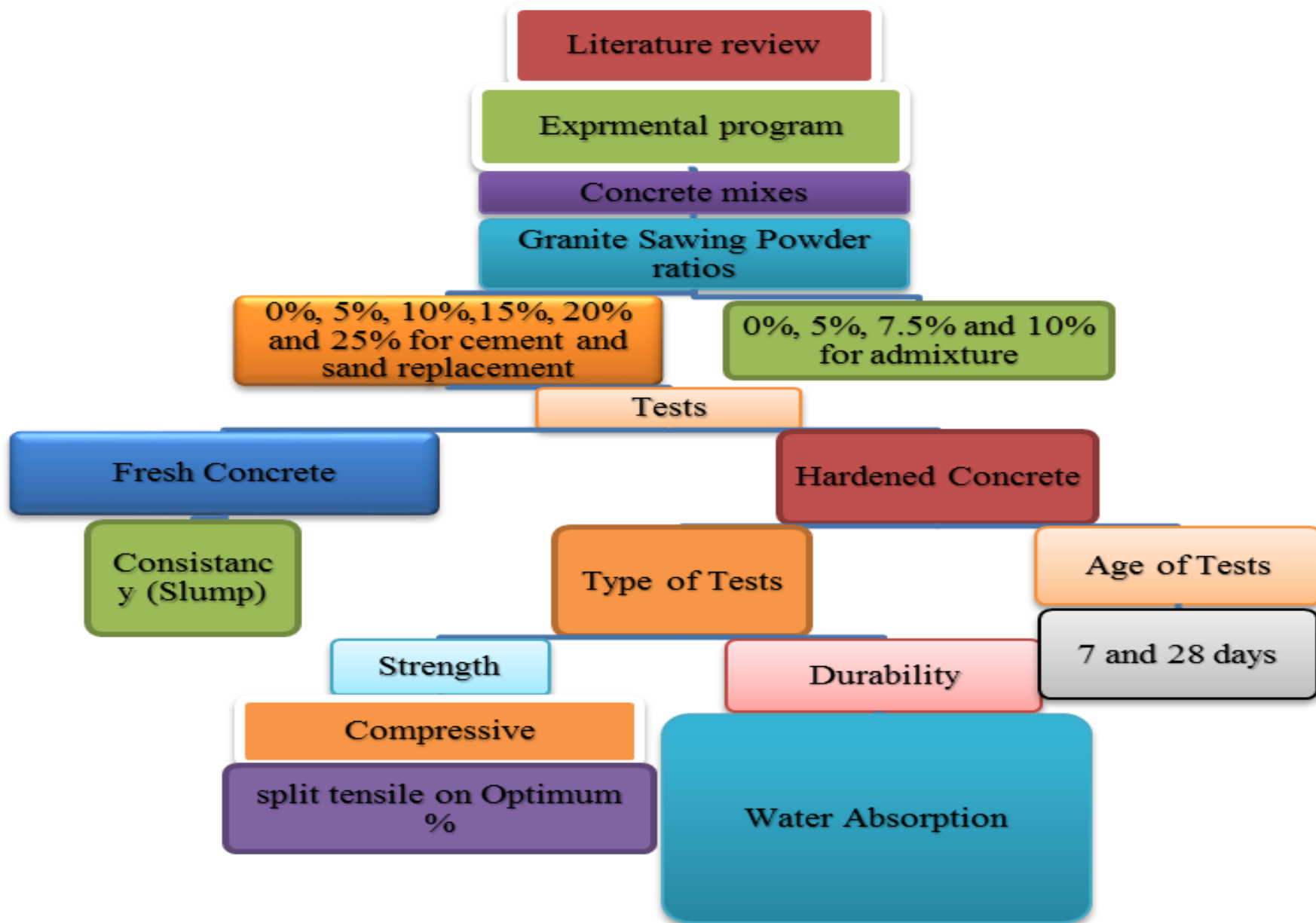
2.1 Sample preparation

Sample were prepared from the following raw materials:

- ✓ 32.5N cement class from **CIMERWA**
- ✓ Natural river sand from **KAYUMBU** quarry was used as fine aggregate
- ✓ Available local crushed stone of 10mm to 28mm was used as course aggregate.
- ✓ Water-cement ration was 0.6.
- ✓ Granite sawing powder from Eastern African Granite industry (**EAGI Ltd**).

Concrete with **1:2:4** mix design were prepared, as the common mix design for concrete work here in Rwanda.

2.2 Research methodology Design Chart



2.3 Raw material characteristics

- Raw materials were assessed for their quality, chemical and physical analysis were done on both cement and granite sawing powder.
- Sieve analysis was done for both fine and course aggregate.
- **Workability**
The effect of granite sawing powder on workability of fresh concrete was studied via slump test, the test was carried for all prepared samples.

2.4 Mechanical characteristics and durability measurement

➤ Compressive is measured by the mean of UTM, and calculated as:

➤ Compressive strength =

$$C = \frac{P}{A}$$

➤ Split tensile strength was by the same machine, it was calculated as:

$$TS = \frac{2P}{D\Pi \times H}$$

2.5 Concrete durability measurement

Durability of prepared concrete blocks was measured via water absorption test for different specimens,

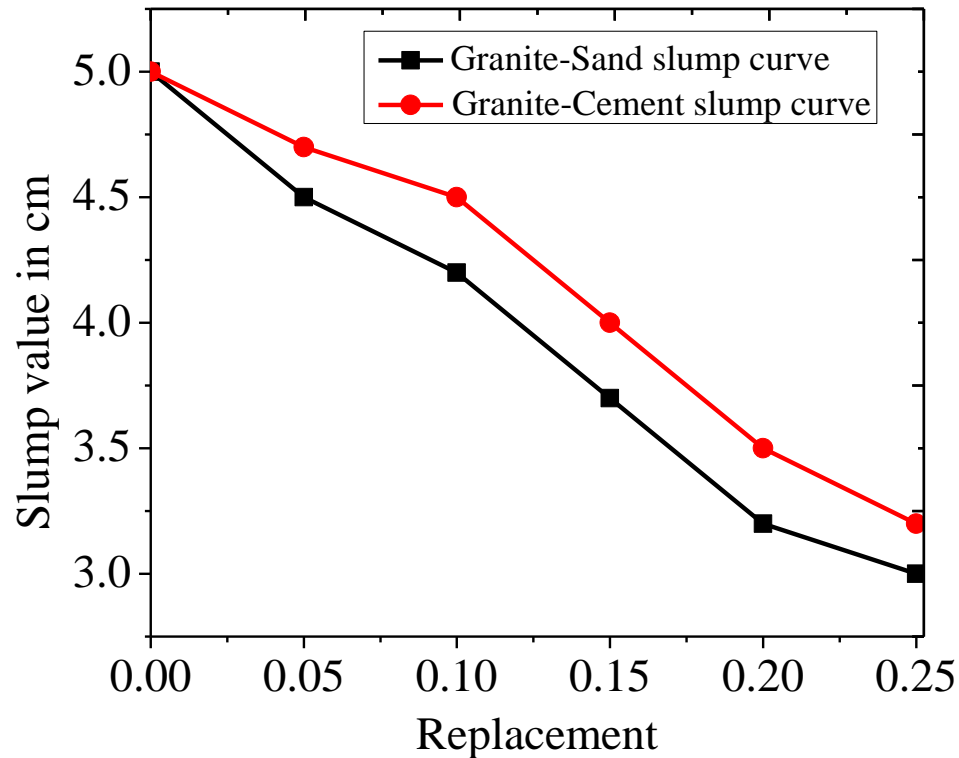
Water absorption is measured by immersing brick sample in cold water within 48 hours and calculated as :

$$W_{abs.} = \frac{(W_2 - W_1)}{W_1} * 100$$

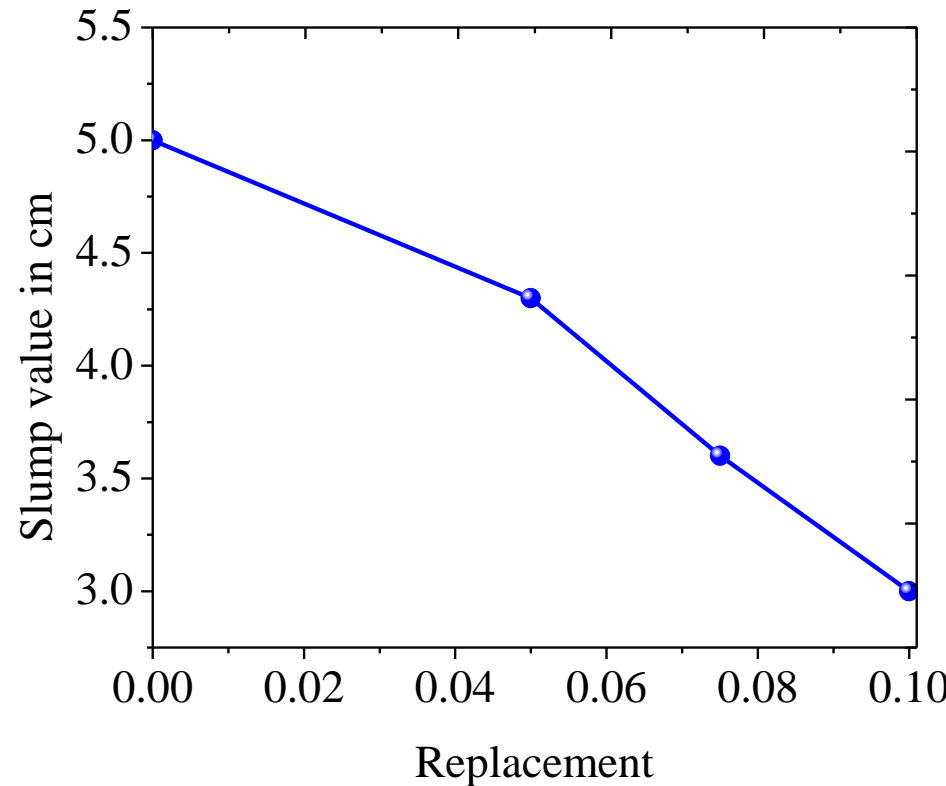
3 Results

3.1 Fresh concrete workability

Slump test values for sand and cement replacement

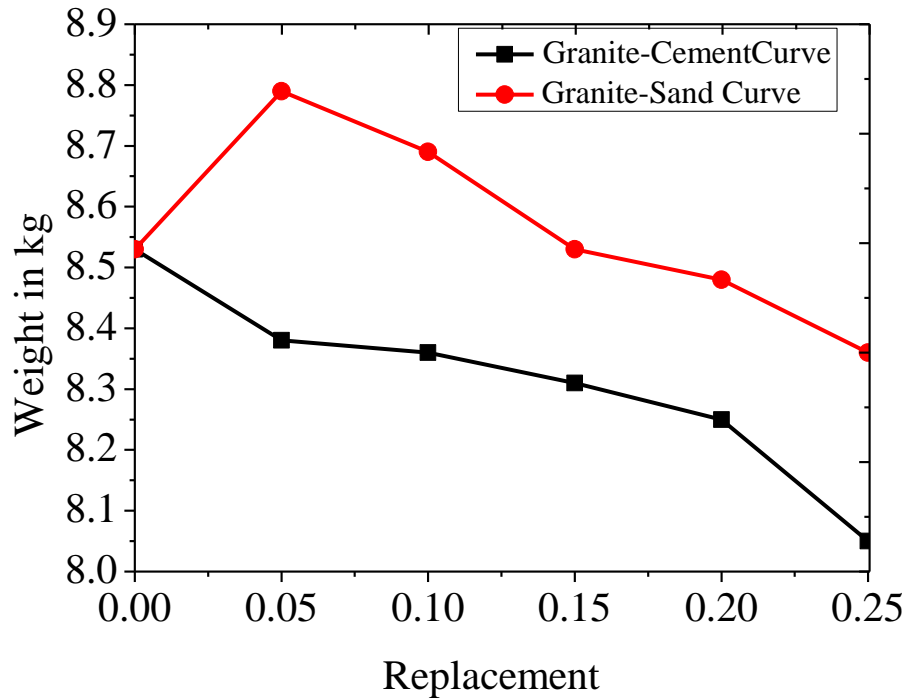


Slump test values granite admixture

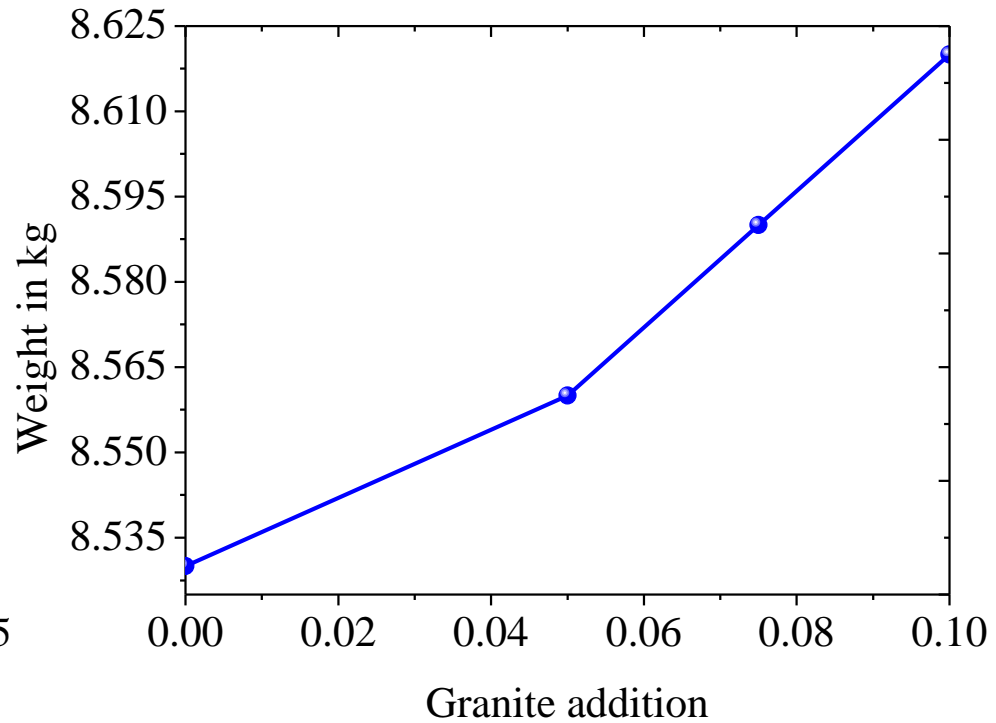


3.2 Weight variation

Weight variation for sand and cement replacement



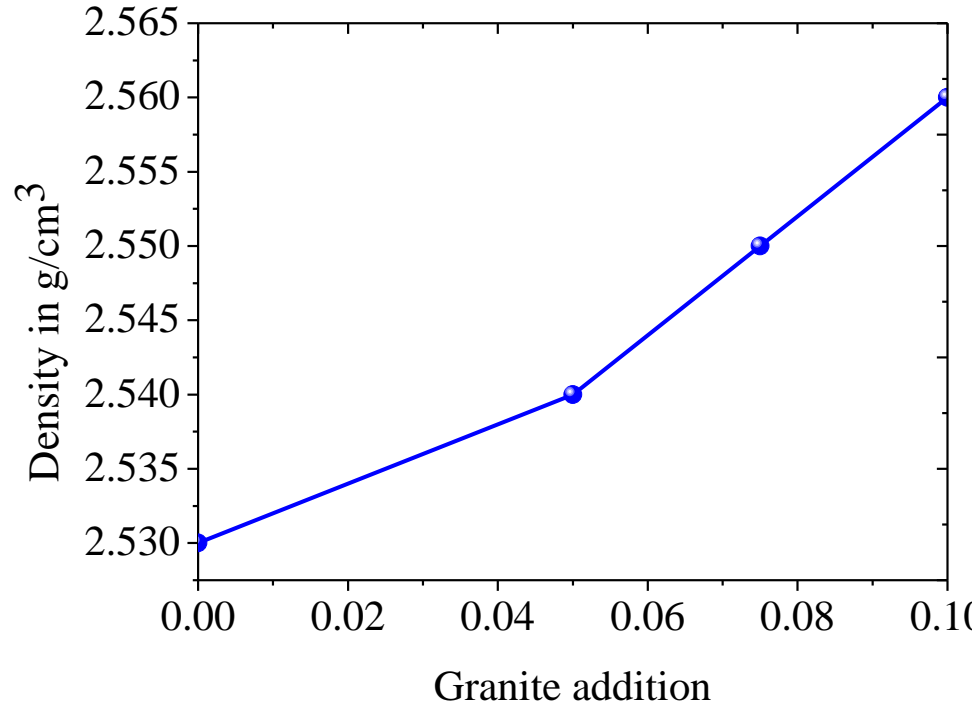
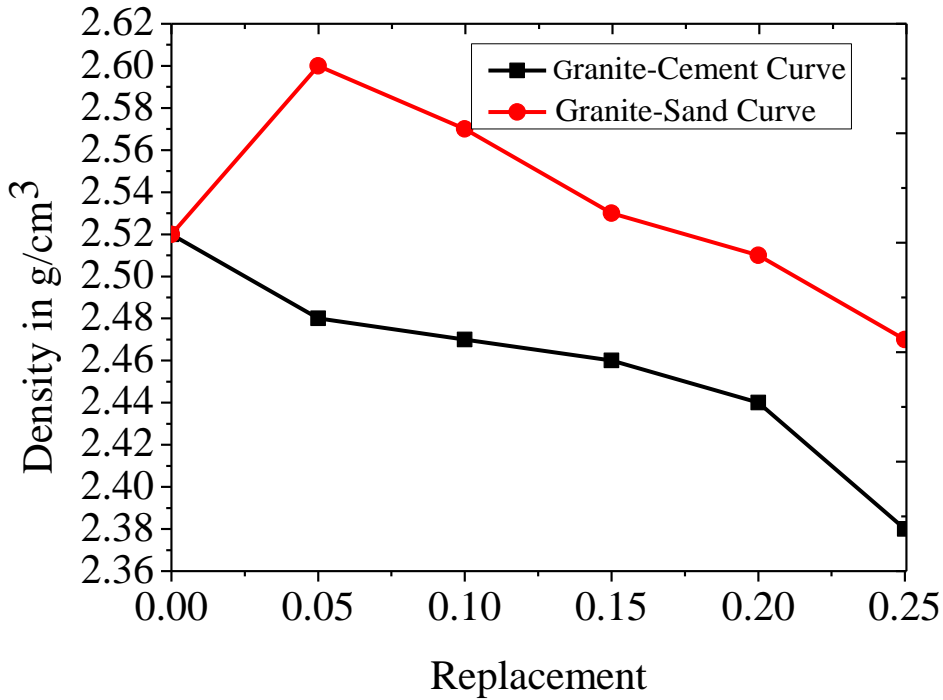
Weight variation for granite admixture



3.3 Density variation

Density variation for sand and cement replacement

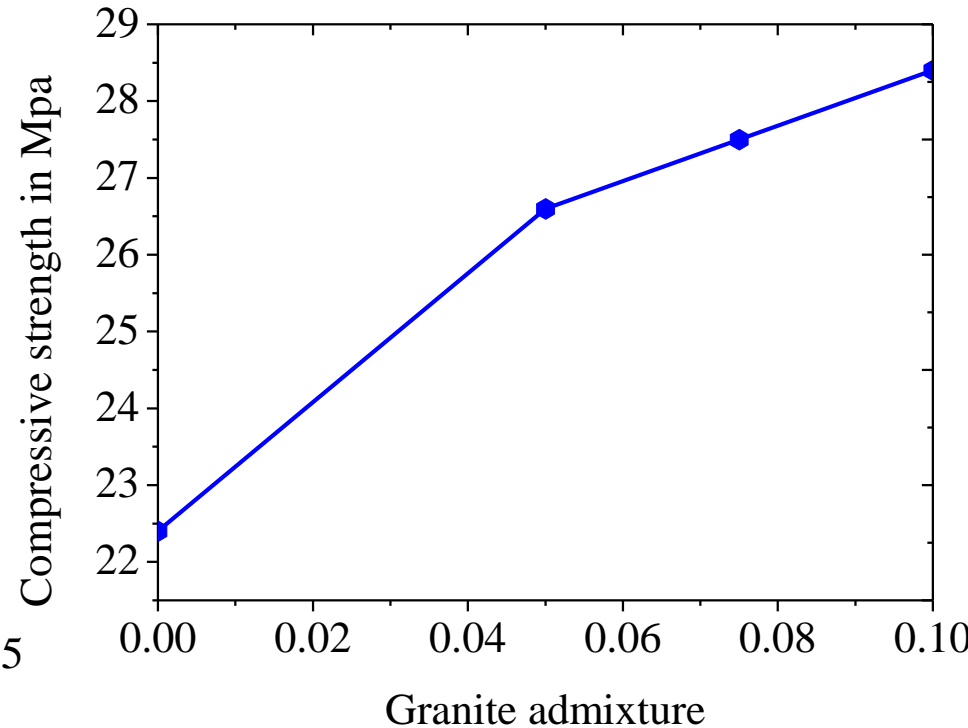
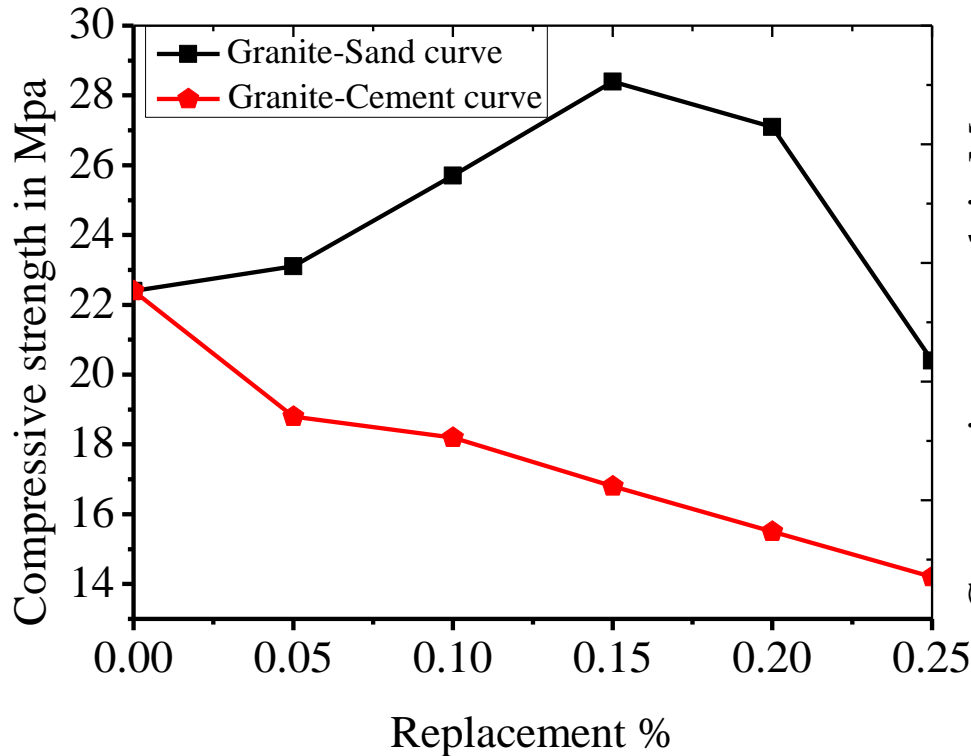
Density variation for granite admixture



3.4 Mechanical characteristics measurement

Compressive strength versus replacement proportion for both sand and cement

Compressive strength versus admixture proportion of granite powder

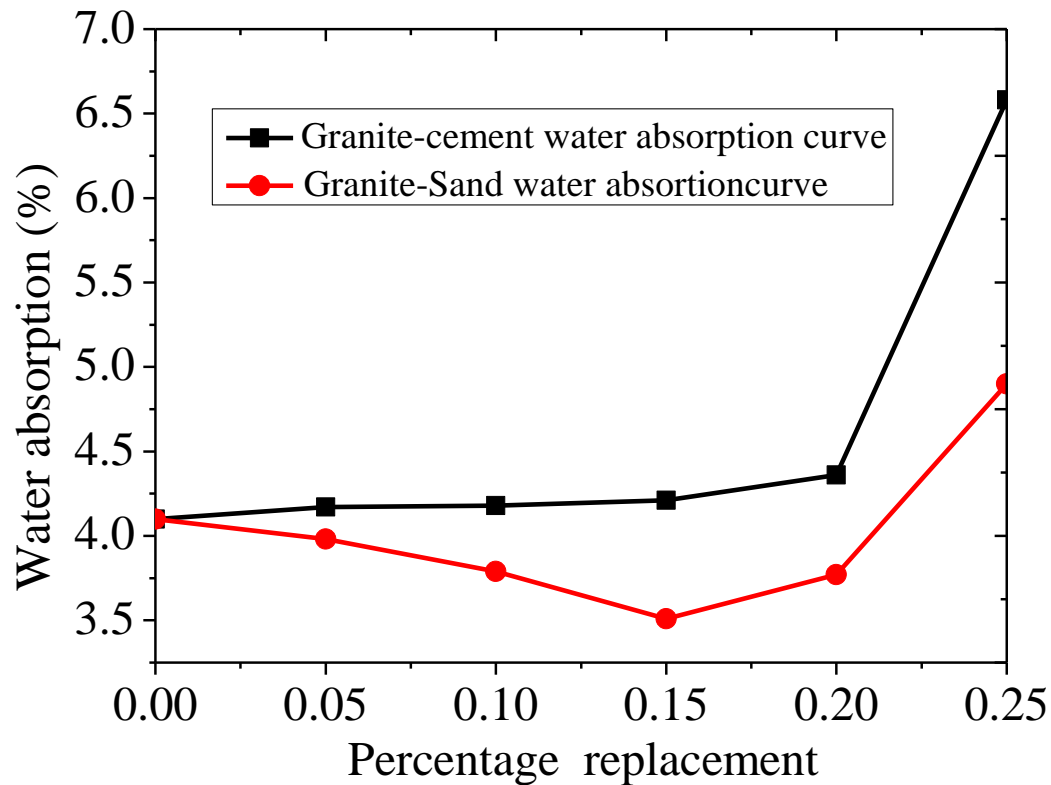


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	5% cement replacement with granite powder (125 μ c)	5% cement replacement with granite powder (180 μ c)
	18.8	17.5
	At 7 days	At 28 days
	1	1.8

3.5 Concrete water absorption

Water absorption for concrete made by sand and cement partial replacement



4 Conclusion and recommendation

4.1. conclusion

- ✓ Laboratory test confirmed that mechanical properties and durability of cement based materials may be changed by the usage of granite sawing powder waste while their manufacturing.
- ✓ The partial substitution of natural river sand by granite sawing powder waste was efficient, 20% and 15% substitution revealed high 28 days strength than other substitutions higher than target 28 days strength.
- ✓ Granite admixture to cement revealed high improvement in compressive strength at 28 days of curing for all concerned admixture proportions.
- ✓ Replacing cement by granite sawing powder caused a decrease in the mechanical properties and durability especially compressive strength compared to the control mix.

4.2 Recommendation

- ✓ Care should be taken when granite is going to replace any raw material; because its excess would lead to the reduction in strength.
- ✓ The use of granite as partial replacement to cement reduces compressive strength, so this option can be taken on small works which do not require very strong concrete. (all people around **EAGI Ltd** and society in general)
- ✓ When granite is used by replacing partially sand in concrete its granular distribution should be studied as the optimum replacement depends on it. Furthermore, water cement ratio ought to be adjusted for keeping workability.
- ✓ Future researchers: optimum admixture proportion, other mechanical properties, the resistance against other harmful solutions such as chloride attack, different chemical attack, concrete behaviors when subjected to the electrical energy.

References

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Thank u very much for your kind
attention.