JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

"PARTIAL REPLACEMENT OF CEMENT WITH SHADU IN CONCRETE"

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Abstract: Concrete is the one of the most widely used construction material throughout the world. Hence it has been labelled as the backbone to the infrastructure development of nation. To fulfill the requirement of industries I have to replace fully or partially the constituent materials of concrete by using shadu. As the construction industry confronts the imperative to reduce its environmental impact and embrace sustainable practices, this capstone project delves into the feasibility and implications of utilizing shadu, a traditional and eco-friendly material, as a partial replacement for cement in concrete. Shadu, a clay-based substance obtained from riverbeds, presents a promising alternative to conventional cement, particularly in construction applications where structural strength requirements are more flexible.

Index Terms – Partial Replacement of Cement with Shadu and Concrete, Test on concrete of comprehensive strength, workability

I. INTRODUCTION

The construction industry is undergoing a profound transformation driven by the urgent need for environmental sustainability and resource conservation. One of the key challenges faced by this industry is the quest for materials and practices that reduce carbon emissions while still meeting the stringent demands of modern construction. In response to these imperatives, this capstone project embarks on a journey to investigate the viability and implications of incorporating shadu as a partial cement replacement in concrete, thus contributing to the realm of sustainable construction practices. Concrete, a fundamental building material, has long been associated with high carbon emissions due to its reliance on Portland cement, a primary component responsible for a significant share of the industry's environmental footprint. It is increasingly evident that the construction sector must adapt and innovate to align with global climate goals and a growing consciousness of ecological responsibility. Shadu, a traditional material derived from riverbed clay, represents an ancient yet remarkably sustainable solution that holds the potential to address these environmental challenges.

The concept of utilizing shadu as a partial cement replacement is rooted in the premise of reducing the carbon intensity of concrete production. Shadu, as an indigenous and renewable resource, offers the opportunity to diminish the reliance on cement while contributing to a more sustainable construction ecosystem. This capstone project seeks to unravel the multifaceted dimensions of this approach, encompassing the technical, environmental, and practical aspects that underpin the adoption of shadu-enhanced concrete. The research endeavor involves a holistic exploration that includes a comprehensive literature review, experimental analysis, and a systematic evaluation of the properties and performance of concrete mixtures containing varying proportions of shadu. By scrutinizing the impact of shadu content on critical factors such as compressive strength, durability, and carbon footprint, this study aspires to provide a nuanced understanding of the benefits and challenges associated with the utilization of shadu in concrete construction.

As a harbinger of sustainable building practices, this capstone project aims to illuminate the pathway toward eco-conscious construction by delivering recommendations and insights

Into the judicious integration of shadu as a partial cement replacement. By striking a balance between environmental stewardship and structural integrity, this research contributes to the evolving narrative of sustainable construction materials and methodologies, reshaping the future of the construction industry in harmony with our planet's ecological imperatives.

II. REVIEW OF LITERATURE

1. Dhanalakshmi G et al., (2015) have studied the " Use of Fire Clay as a Partial Replacement in Concrete ''.

Researchers all over the world today are focusing on ways of utilizing either industrial or agricultural waste, as a source of raw materials for industry. This waste utilization would not only be economical, but may also result in foreign exchange earnings and environmental pollution control. Industrial wastes, such as fly ash and silica fume are being used as supplementary cement replacement materials. Currently, there has been an attempt to utilize the large amount of fire clay, the residue from an industry. Therefore, it is possible to use fire clay as a sand replacement material to improve quality and reduce the cost of construction materials. Recycling in concrete has advantages since it is widely used and has a long service life, which means that the waste is being removed from the waste stream for a long period. On the other hand, the modern technological society is generating substantially high amounts of solid wastes both in municipal and industrial sectors; posing an engineering challenging task for this effective and efficient disposal. Hence, partial or full replacement of cement by the other compatible materials like sintered fly ash, crushed rock dust, quarry dust, glass powder, recycled concrete dust, and others are being researched from past two decades, in view of conserving the ecological balance.

This will not only provide new material for construction but also will help the preservation of the environment and can also help the economy by providing new use for the fire clay. Concrete is generally composed of aggregates, cement and water. The aggregates are usually coarse and fine aggregates. The aggregates should have good mechanical properties in terms shape, density, grading, hardness, purity to achieve the required strength and durability.Compressive strength of control mix at the age of 28 days Is 56.44 N/mm2. More over the compressive strength of 10%,20% ,30% are reached the target strength of M30 Grade mix. Similarly the flexural strength and the split Tensile strength are to be higher than the design targeted Strength. Then the water permeability is also found to be Lower than the limited value (25mm) and the rapid chloride Penetration test results are within the moderate range. The Penetration of water and chloride ion is lower in the Specimens tested and hence the causes of corrosion will be Low.

They Concluded That

[1] Based on the findings from the study the partial Replacement of fireclay with upto 30% replacement is Recommended for use in concrete production for use in Construction where crushed sand and fireclay is in Abundance and river sand is scarce.

[2] Unit weight of fireclay is higher than that of river sand Aggregate in dense condition which in turn , contributes The increase in the fireclay as a fine aggregate.

[3] Concrete specimens were prepared with proportions of 10%, 20%, 30%, and 40% for M30 grade concrete mix. The test results shows clearly that fire clay as a partial sand Replacement has beneficial effects of the mechanical Properties of high performance concrete of the proportions Upto 30% were considered and the cost of concrete is also reduced and hence it becomes more economical without compromising concrete strength than the conventional Concrete.

2. Partial Replacement of Cement with Commercial Available Rice Husk Ash in concrete Issued on 31 August 2021 By International society of manufacturing, service and management engineering

Natural coagulants are now proving to be good substitutes for chemical coagulants due to their availability, cost effectiveness, nontoxic and biodegradable natures. In this research work, the treatment of highly turbid surface water by coagulation method with sesame and peanut seeds as a natural coagulant has been investigated. This study investigates the potential, suitability, effectiveness and efficiency of sesame and peanut seeds as an environmental friendly and natural coagulant for the treatment of high turbid water, and the effect of each one of the coagulant on the pH of the water, as well as a comparison between the two natural coagulant as which one is more effective in removing the turbidity from water. The sesame and peanut seeds have been used after extraction of the active coagulation component by distilled water and salt solution. The results obtained from the jar test showed that peanut seeds extracted with KCL could effectively remove 88.3% of the 340 NTU turbidity using only dosage of 20 mg/l, while sesame seeds extracted could remove only 79.7% of the 344 NTU turbidity using dosage of 60 mg/l . Moreover, the results showed that the peanut seed is more effective in removing the turbidity from water more than the sesame seeds as it is not that effective in removing turbidity from water. So, it has been demonstrated, in this work, that peanut seed is one of the promising natural coagulants for water treatment Concrete is the world most used construction materials for many structural purposes due to its naturally high compressive strength but production of cement, one of its main ingredients which contribute to the concrete strength, require high amount of energy, costly and release tremendous amount of CO2 to the atmosphere causing global warming and climate change.

By incorporating waste material which has pozzolanic properties as partial replacement of cement can contribute to a lower production cost and environmental friendly. Rice husk has been identified as having the greatest potential as it is widely available and, on burning, produces a relatively large proportion of ash, which contains around 80% - 90% of silica. There are 2 types of silica present in rice husk ash (RHA) which are amorphous and crystalline form. The former being more reactive towards pozzolanic activity and can be achieved through controlled burning. The purposes of this study are to determine the workability and compressive strength of concrete incorporating commercial based rice husk ash as well as the optimum replacement level of RHA based on the concrete compressive strength.

3. Engr. Abdul Ghayoor khan, Dr. Bazid khan et al., (2017) have studied the "Effect of Partial Replacement of Cement by Mixture of Glass Powder and Silica fume Upon Concrete Strength''.

In concrete cement can be partially replaced by different supplementary cementitious materials. In the recent years pozzolonic materials, glass powder and silica fume are used in concrete as a partial cement replacement to improve the strength of concrete.

In this research work the mixture of glass powder and silica fume were used in concrete as a partial cement replacement, to study its effect upon concrete strength. The mix proportion of 1:2:4 was selected for all the concrete samples with water to binder ratio of 0.55. For comparison, a control sample of concrete was prepared without mixture of glass powder and silica fume to compare it with the various samples containing different percentages of mixture of glass powder and silica fume as a partial replacement of cement in concrete. Results discovered that the usage of mixture of glass powder and silica fume in concrete as a partial replacement of cement increases the concrete strength. Such as compressive strength increases up to 8.64%, tensile strength increases up to 15% and flexural strength increases up to 7.08% at the age of 28 days. It is concluded that maximum strength is achieved at 28 days by 30 percent replacement of cement through mixture of glass powder and silica fume in concrete and the strength was decreased by increasing the mixture of glass powder and silica fume content beyond 30 percent.

They Concluded That,

30 percent replacement of cement is the optimum amount to achieve the higher strength. From the SEM analysis of concrete samples it's proved that both the pozzolonic materials contribute in hydration process and further validated the strength test results.

4. Patricia Krawczak et al., (2022) have studied the "Eco-friendly concrete using by-products as partial replacement of cement''.

The current challenge facing the construction industry is to produce sustainable concrete at the lowest feasible cost. One obstacle to that is the demand for an excessive amount of cement. The reduction of cement content can be achieved byits partial replacement with by-product materials that attain an appropriate pozzolanic index. Two by-products namely; Ceramic waste powder (CWP) and rice husk ash (RHA) are remarkably formed throughout tiles and rice production. Using these by-products as a partial substitution for cement reduces landfills, the cost of concrete, and climate change due to cement production. This paper investigates the effect of replacing 5%, 15%, 20%, 25%, and 30% of cement with CWP. Varied proportions of RHA; 5%, 10%, 15%, and 25% were added to the mix with the optimum CWP. The concrete mixture was proportioned to produce M35-grade concrete. Properties of concrete were assessed concerning workability, compressive, splitting tensile, and flexural strength. The results are compared to conventional concrete with 0% replacement.

They Concluded That,

Results identified that 20% substitution of cement by CWP is the optimum percentage. It increases the compressive, splitting tensile, and flexural strength by 11%, 20%, and 12.5% respectively. Increasing the percentage up to 30% has minor effect on tensile and flexural strength but has destructive effect on compressive strength. Blending cement with CWP and RHA additionally improves the mechanical properties. The combination of 20% CWP/10%

RHA propose superior strength, it increases the compressive, tensile, and flexural strength by 14%, 28%, and 19% compared to the control concrete.

5. Aditya Kumar Saini, Abhinav Singh, Abhishek Tiwar et al., (2021) have studied "Partial replacement of cement concrete by waste materials".

The aim of the study is to reduce the corn cob and saw dust waste materials and reduce the cost of concrete. Chemical composition of corn cob ash (CCA) and saw dust ash (SDA) as well as the workability and compressive strength properties of varying percentage of corn cob ash and saw dust ash cement concrete and 100% cement concrete of mixing ratios 1: 1.5: 3, 1:1:2 and water – cement ratios of 0.5 which later increased to 0.6 were examined and compared. Slump test was carried out to check the effect of corn cob ash and saw dust ash on the workability of fresh concrete. A total of 90 concrete cubes of size 150mm x 150mm x 150 mm with different percentages by weight of corn cob ash and Saw dust ash to Portland cement in the order of 0%, 10% and 15% were cast. The concrete cubes were tested at the ages of 7, 14, 21, 28 and 56 days. The results showed that the corn cob ash and saw dust ash are a good pozzolans.

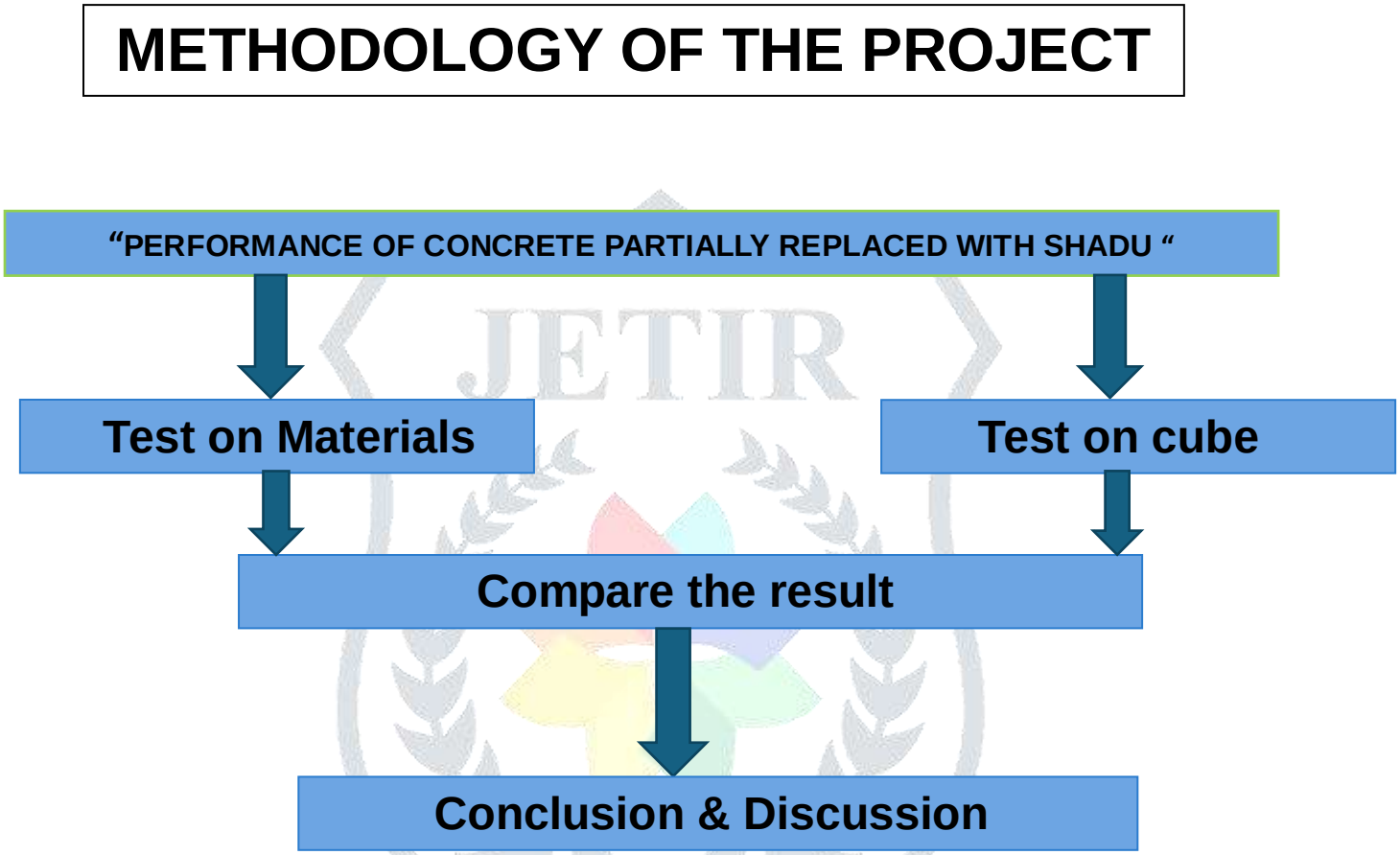
The slump value decreasedas the CCA and SDA contents increased indicating that concrete becomes less workable as the ashes content increased. The compressive strength of the concrete cubes increased as the days of curing increased and decreased with increasing ashes replacement. The highest compressive strength was 24.9N/ mm2 and 22.4N/ mm2 at 56 days

for 0% and 10% of CCA (M25) and 24.9N/ mm2, 23.9N/ mm2 for SDA (M25) respectively.

They Concluded That,

It was concluded that the use of CCA and SDA as a partial replacement for cement in concrete, particularly in plain concrete works and non – load bearing structures, will improve waste to wealth initiative though only 10% CCA and SDA replacement is adequate to enjoy maximum benefit of strength gain.

III. EXPERIMENTAL METHODOLOGY



RESULTS AND DISCUSSION

THE FOLLOWING ARE THE RESULTS FROM THE TEST CONDUCTED ON THE MATERIALS AND THE CONCRETE CONTAINING PARTIALLY SHADU

Sr. No.	Test Conducted	Results (with Shadu)	Without Shadu
1.	The fineness of cement	7%	8%
2.	Consistency of cement	39% (5% shadu)	36%
3.	Initial setting time	27 mins	29 min
4.	Final setting time	9 hr 10 mins	9 hr 55 min
5.	Compressive strength		

	5% shadu	21.55 N/mm^2	23.53 N/mm^2
	10% shadu	19.13 N/mm^2	
	15% shadu	16.78 N/mm^2	
	20% shadu	14.84 N/mm^2	
6.	Slump Cone test	6.5 mm	8.3 mm
7.	Compaction factor	0.82	0.92

CONCLUSIONS

Towards a sustainable future with shadu clay

- Summary: Shadu clay reduces environmental impact by lowering carbon emissions. Promotes cost efficiency and local resource utilization. Aligns with global green building goals.
- Key Takeaways: Experimental results demonstrate the viability of Shadu clay as a partial replacement for cement. Cost Efficiency: A 4.28% reduction in the cost of 1 cubic meter of concrete was achieved with 7.5% Shadu clay replacement. Challenges like mix optimization and awareness can be overcome with research and innovation.
- Call to Action: Advocate for sustainable practices in construction. Encourage further research and industry adoption of eco-friendly materials like Shadu clay.

REFERENCES

[1] Gupta, A., Sharma, S. K., & Kulkarni, S. V. (2020). A review on properties of shadu based geopolymer concrete. Materials Today: Proceedings, 22, 926-934.

[2] Hadda, T. B., & Diwan, M. (2019). Sustainable Building Materials from Traditional.

[3] Mud and Clays. In S. Shahid, A. A. C. N. Perera, & S. Pant (Eds.), Geoenvironmental Practices and Sustainability: Linkages and Directions (pp. 53-75). Springer.

[4] IS 456:2000 – Code of Practice for Plain and Reinforced Concrete.

[5] IS 3370 – Part 2:1975 – Code of Practice for Concrete Structures for the Storage of Liquids – Reinforced Concrete Structures.

[6] IS 10262:2019 – Guidelines for Concrete Mix Design Proportioning.

[7] IS 383:1970 – Specification for Coarse and Fine Aggregates from Natural Sources for Concrete.

[8] IS 1489 – Part 1:1991 – Portland Pozzolana Cement – Specification.

[9] IS 456:2000 – Code of Practice for Plain and Reinforced Concrete (Reaffirmed 2020)

[10] https://www.forconstructionpros.com/concrete/article/21072546/giatec-scientific-inc- 7-methods-for-testing-concrete-strength

[11] https://chat.openai.com/

[12] Concrete Technology Manual (22305)

[13] Shri. Nilejit Ramchandra Mali, Dr.J.M.Shinde (2024). Performance of Manufactured Sand in Concrete at Elevated Temperature Volume 11 Issue 5 May-2024 eISSN: 2349-5162