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AN EXPERIMENTAL STUDY OF CONCRETE WITH PARTIAL REPLACEMENT OF CEMENT BY ALGAL WEED ASH- A REVIEW

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Abstract: - Concrete is one of the world's most important construction materials owing to its strength and versatility. Due to its enormous strength and ability to take on almost any form, concrete is one of the world's most essential building materials, with a wide variety of qualities and components i.e., fine aggregates, coarse aggregates, cement, and water mixed in appropriate proportions. The expansion of infrastructure requires a large quantity of cement, so cement industries must create a huge amount of cement to fulfill this demand. However, the high cost of construction materials like cement, used as a binder has raised the expense of building alternative materials. In addition to cost, cement production is also responsible for global warming due to the release of high energy and carbon dioxide gas into the atmosphere. These challenges push researchers to discover supplemental cementing elements that will minimize the cost of construction materials. Nowadays, cost reduction in production and the search for a new and realistic alternative are critical aspects of natural resource conservation. Since the last few decades, waste materials from various sources such as industrial and domestic wastes such as fly ash, blast furnace slag, silica fume, rice husk, oil palm shell, eggshell, etc. have been used as partial substitutes for various materials used in concrete to increase strength while remaining economical and pollution-free. Algal weed ash is utilized as an excellent replacement for fractional cement. Algal weed ash is generated from the processing of algal weeds and can be used as a partial replacement of cement in producing concrete. Algal weed ash concrete is a result of optimizing the addition of admixture to M30 grade concrete and it has been shown in numerous properties of concrete. This research work has been performed to find a successful way for the partial replacement of cement with algal weed ash. Here, M30 grade concrete with a mix proportion of 1: 2.31: 3.90 with a water/cement ratio of 0.5 was used. An experimental examination was carried out in the preliminary study to examine the Cube Compressive Strength of concrete by partially replacing the cement with 1%, 2%, and 3% ash.

Keywords:- Green concrete, algal weed ash, building material, waste, pollution-free, circular economy

1. INTRODUCTION

The term "concretus" is derived from a Latin word for condensed or compacted, as well as the excellent passive participle of "concrescere," which originated from the prefix "con-" (together) and the verb "crescere" (to grow) (Irwin, 2018). Each year, over ten billion tons of concrete are generated, making it one of the most consumable commodities on the entire globe, second only to water. A particularly strong and malleable building material, concrete is primarily composed of cement, gravel, and aggregates (e.g., sand or broken stones) combined with slurry in an acceptable mix proportion (Watts, 2019). The paste, which is a combination of water and Portland cement, covers the surface of the coarse and fine aggregates during a reaction known as hydration, solidifying, and increasing durability to produce the stone structure. Similar to the bulk referred to as concrete, even expert structural engineers occasionally use the terms "cement" and "concrete" interchangeably, while in actuality, cement is an ingredient of concrete (Juenger et al., 2011).

Figure 1 Removal of algal weed in Dal lake

Figure 2 Manual removal of algal weed

Figure 1 Dal Lake defaced by algal weed

2. OBJECTIVES OF STUDY

1. To determine the mechanical and durability qualities of concrete containing Algal weed ash.
2. To compare the efficacy of Algal weed-infused concrete to that of conventional cement concrete.
3. To determine the optimal proportion of algal weed ash in concrete for maximum.

3. LITERATURE REVIEW

The marine brown algae were employed as additional material at 2%, 5%, 8%, and 10% of the cement content, with the use of a predetermined ratio of water to cement (W/C = 0.5), to generate concrete of M25 quality. Tensile strength tests were performed at 3, 7, and 14 days (Ramasubramani et al., 2016). The results indicated that the inclusion of marine algae either boosted or lowered the hardness qualities of concrete. However, when additional marine algae are added, the compressive strength tends to diminish. Deflection characteristics tests revealed that optimal mixed concrete beams had a greater ultimate load-bearing capability than standard concrete beams. Thus, the study found that adding 8% marine algae to concrete boosted its strength qualities, but when raised to 10%, the capabilities began to deteriorate.

Murugesh & Balasundaram, (2017) assessed the usage of bio-waste as a cementitious material for the first time and demonstrated the future possible benefits of cement concrete with water hyacinth ash. The flexural modulus, compression strength, and workability, of blended concrete containing varying percentages of ashes from water hyacinth as a replacement on a partial basis for cement, was investigated. At a rate of 10 to 20 percent by weight, the cement was replenished in the concrete. Finally, a 7-day-cured concrete cube was evaluated to compare the Durability and strength characteristics of ash-based composites concrete to ordinary concrete. In light of the findings of the investigation, it was determined that the optimal proportion of ash from water hyacinth to cement equaled 10% for concrete of M30 grade.

Salas-Ruiz et al., (2019) studied a microstructural and chemical evaluation of the water hyacinth petiole was undertaken to determine the most efficient and usable building material. Two types of binder-free insulating panels with two particle sizes (pulp and staple) were produced for this purpose. The boards were characterized physically, mechanically, and thermally, and the results revealed that self-supporting water hyacinth petiole panels may be manufactured without the need for an artificial polymer matrix for thermal insulation. Thermal conductivity values of 0.047–0.065 W/mK were observed on the boards. Additionally, distinct changes in the characteristics of the boards were observed according to the kind of water hyacinth petiole particle size owing to microstructure variances.

Sivakrishna et al., (2020) investigated the use of sustainable alkali-activated binders, supplemental cementitious materials, and recycled materials in concrete as raw materials. It was discovered that by including new ingredients, it is feasible to create greener concrete with better quality compared to ordinary concrete. Additionally, it was discovered that the novel materials outperformed the standard ones.

Soban et al., (2017) investigated the possibilities for using water hyacinth fibers (WHF) to partially replace fine aggregate. WHF was employed in place of fine aggregate at concentrations of 0.5, 1, 1.5, and 2 wt. percent. The flexural strength of concrete cubes and cylinders was analyzed up to a 28-day age. The results of the tests indicate that concrete cubes containing 0.5 percent WHF in place of fine aggregate had a comparably high compressive strength. The usage of WHF in concrete revealed increased absorption properties of water, durability, and compression power at elevated temperatures.

Murugesh & Balasundaram, (2017) explored the use of water hyacinth ash (WHA) as a cement reinforcement in short-column concrete under axial loading conditions. The columns' strength was studied with various quantities of cement substituted by 0% and 10%, respectively, of the cement weight for M30. The WHA substitution enhanced the curing time of concrete and also reduced its potency. Five columns were evaluated: two conventional (reinforced concrete columns (RCC) and three RCC columns with 10% replacement. The trial results indicated that the best percentage of WHA added to concrete is 10% relative to the weight of cement. The findings indicate that WHA may be employed as a cement alternative in concrete.

4. CONCLUSION

The findings of the tests on the fresh concrete and the hardened concrete were discussed in this work . It is also described how the workability test result of the hardened concrete qualities, such as compressive strength, influenced the final product. Based on the findings of the inquiry, the best feasible mixing combinations are discovered and discussed. When it comes to compressive strength, the mix with 2 percent algal weed ash had the most positive synergistic impact out of all the combinations tested. When algal weed ash was increased in fresh concrete from 0% to 3%, the setting time of cement also increased from 182minutes to 277minutes. The results of the durability tests, such as water absorption, are also mentioned.

REFERENCES

1. Alexander, M., Bentur, A., & Mindess, S. (2017). Durability of concrete: design and construction. CRC Press.
2. Boban, J. M., Nair, P. V, Shiji, S. T., & Cherian, S. E. (2017). Incorporation of Water Hyacinth in Concrete. International Journal of Engineering Research & Technology (IJERT), 6(05).
3. Concrete, F. I. B. I. F. S. (1989). Durable concrete structures CEB design guide second edition. FIB - International Federation for Structural Concrete. https://books.google.co.in/books?id=UyahDwAAQBAJ
4. Dal Lake defaced by weeds – Kashmir Reader. (2020). https://kashmirreader.com/2020/08/16/dal-lake-defaced-by-weeds/
5. Irwin, M. P. S. (2018). BRITISH ORNITHOLOGISTS'CLUB. Bull. BOC, 138(1), 1.
6. Juenger, M. C. G., Winnefeld, F., Provis, J. L., & Ideker, J. H. (2011). Advances in alternative cementitious binders. Cement and Concrete Research, 41(12), 1232–1243.
7. Kulkarni, P., & Muthadhi, A. (2017). Seaweed as an Internal Curing Agent & Strengthening in

Concrete–A Review. SSRG International Journal of Civil Engineering, 4(6), 94–97.

8. McManus, R. S., Archibald, N., Comber, S., Knights, A. M., Thompson, R. C., & Firth, L. B. (2018). Partial replacement of cement for waste aggregates in concrete coastal and marine infrastructure: a foundation for ecological enhancement? Ecological Engineering, 120, 655–667.
9. Mike Robinson. (2017). Floating Weeds & Weeds with Floating Leaves. https://keystonehatcheries.com/blogs/weed-algae-control/floating-weeds-weeds-with-floating-leaves
10. Nawy, E. G., & Eng, D. (1997). Long term effects and serviceability. Concrete Construction Engineering Handbook, 1–4.
11. Ramasubramani, R., Praveen, R., & Sathyanarayanan, K. S. (2016). Study on the strength properties of marine algae concrete. Rasayan J. Chem, 4, 706–715.
12. S. Dinesh, V. M. (2017). Experimental Behaviour of Water Hyacinth Ash as the Partial Replacement of Cement In Concrete. IJSTSET. https://1library.net/document/y4909rrz-experimental-behaviour-hyacinth-partial-replacement-cement-concrete-murugesh.html
13. Tamrin, T., Pratama, F., Purnomo, R. H., & Davitri, N. (2017). Aquatic and Dry Land Weeds as Potential Renewable Fibers Resources for Paper. Sriwijaya Journal of Environment, 2(2), 46–49.
14. Uygunoğlu, T. (2011). Effect of fiber type and content on bleeding of steel fiber reinforced concrete. Construction and Building Materials, 25(2), 766–772.
15. Waters, C. N., & Zalasiewicz, J. (2018). Concrete: the most abundant novel rock type of the Anthropocene. Encyclopedia of the Anthropocene, 1, 75–85.
16. Watts, J. (2019). Concrete: The most destructive material on Earth. The Guardian, 25, 1–9.
17. Weeds, red algal bloom deface Dal. (2016). https://www.greaterkashmir.com/srinagar/weeds-red-algal-bloom-deface-dal
18. Zimdahl, R. L. (2018). Aquatic Weeds - an overview | ScienceDirect Topics. Fundamentals of Weed Science (Fifth Edition). https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/aquatic-weeds

