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Experimental Study on Replacement of Aggregate by Kotastone Waste Aggregate

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Abstract – In an effort to lessen its impact on the environment, the construction sector is continuously looking for sustainable substitutes for conventional building materials. The purpose of this study is to determine whether Kota stone waste aggregate (KSWA) can be used in concrete in place of conventional coarse aggregate. The purpose of the study is to evaluate the durability and mechanical qualities of concrete mixtures with different KSWA percentages. Compressive strength, flexural strength, and water absorption of concrete specimens with 0%, 25%, 50%, 75%, and 100% replacement of coarse aggregate with KSWA are all tested as part of the experimental program. To assess the possible advantages and disadvantages of utilising KSWA, the outcomes are contrasted with those of standard concrete.

***Key Words*:** fine aggregate , natural aggregates, compressive strength, workability.

1. INTRODUCTION

One of the biggest users of natural resources, such as aggregates, which are necessary ingredients in the making of concrete, is the building sector. Concerns over the depletion of natural resources and environmental damage linked to aggregate extraction have been highlighted by the rising demand for these products. Using waste from different sectors as aggregates in the manufacturing of concrete is one promising strategy. This preserves natural resources while also lessening the negative effects of garbage disposal on the environment. Popular natural stone used in building, kota stone produces a lot of trash when it is cut and shaped. Inadequate management of this trash might lead to pollution in the environment.

2. OBJECTIVE

Concrete ranks as the second most utilized material globally, following water. In India, the annual consumption of concrete stands at approximately 400 million metric cubic meters, a figure that continues to escalate. This surge in demand threatens to disrupt the equilibrium between material availability and necessity. Consequently, there arises a pressing need for an alternative material to alleviate this imbalance. This study proposes the utilization of kotastone waste aggregate a viable alternative. The objectives of this research encompass exploring the effective utilization of kotastone waste aggregate and investigating its impact on the compressive and its workability.

2.1 MATERIALS

2.1.1. KOTASTONE WASTE AGGREGATE CHIPS:

We can use waste kotastone chips that are not use in further any construction .

2.1.2. Fine Aggregate:

Fine aggregate was purchased which satisfied the required properties of fine aggregate required for experimental work and the sand conforms to zone III as per the specification of IS: 383:1970

2.1.3. Coarse Aggregate:

Crushed granite of 20mm maximum size has been used as coarse aggregate. The sieve analysis of combined aggregates confirms to the specifications of IS: 383:1970 for graded aggregates.

2.1.4. CEMENT: Ordinary Portland cement grade - 43 was used for the test. Which is confirming to IS 8112- 1989.

3. METHODOLOGY

Ordinary Portland cement of grade 43 was employed as the binding material, meeting the stipulations outlined in the Indian standards, IS 8112: 2013. Coarse aggregate was procured from a nearby quarry, while sand was acquired from a local supplier. Kotastone chips, sourced from a factory, served as the alternative material. The concrete mix adhered to a ratio of 1:1.5:3 by volume, serving as the control. Various percentages of shredded plastic, ranging from 1% to 4% by weight, were used to replace sand. A water-cement ratio of 0.45 was maintained throughout. Concrete production involved the thorough mixing of constituent raw materials in a concrete mixer. Nine specimens of each mix were fabricated, utilizing cast iron moulds measuring 150mm×150mm×150mm internally, as per IS: 456-2000 standards. Following a 24-hour casting period, the specimens were de molded and transferred to a curing tank until the day of testing. Compressive strength tests were conducted at 7, and 28 days of curing and tested on compression testing machine. On the testing day, specimens were removed from the curing tank, cleaned with a soft towel, and placed on the laboratory surface for analysis. Results presented reflect the average of three samples from the same mixture. All tests were conducted at the Concrete Technology laboratory within the civil engineering department.

3. RESULTS

The workability of concrete is an important property to determine before placing Concrete. Concrete with a high compaction factor is said to be more workable.

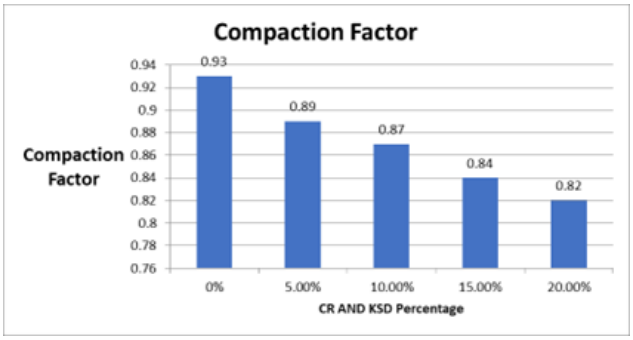


Fig 3.1: Compaction factor

Table 3.1 shows values of compaction factor for the different values of kotastone chips in Concrete. Concrete without kotastone chips has a high compaction. factor, whereas Concrete with maximum kotstone chips showed the lowest compaction factor. Compaction Factor of Concrete with kotastone chips The comparison of Compaction factor for various kotastone chips content percentages. compaction factor of concrete decreases accordingly; hence the workability decreases. So Concrete with 0% kotstone chips has high workability, and Concrete with 2.0% has the lowest workability.

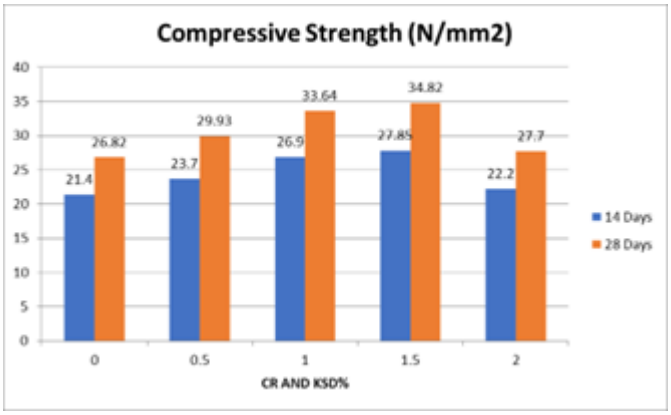
Slump Test

S No.	Control Mix	Slump(mm)
1	M20	75 mm

Table No. 3.2 Slump for Control mix of M20 grade concrete

Compressive Strength

Compressive Strength of Concrete Compressive strength of Concrete is the utmost property of Concrete. Cubes of dimensions 150×150×150 mm were cast and testes for compressive strength on the compression testing machine.



4. CONCLUSIONS

In this experiment, the mix design of M-20 grade concrete was conducted according to the reference IS 10262:2009, with a water-cement ratio of 0.45. Various percentages of kotastone aggregates (ranging from 0% to 50%) were added to the concrete mix. Precise casting of specimens with plastic aggregates was carried out, followed by curing for 14 days and 28 days. Compaction factor tests and slump tests were performed during casting to verify the workability of the fresh concrete with different percentages of added kotastone chips.
After the concrete reached its maturity period, compressive strength tests, split tensile tests, and flexural strength tests were conducted on all specimens, each cast on a specific date. Analysis of the results revealed that the compressive strength generally increased with the percentage of kotastone chips aggregate up to 40%. However, beyond 40% of aggregate, there was a decrease in compressive strength for both 14 days and 28 days cube strength. The study indicated that the optimal percentage increase in compressive strength occurred at 40% for both 14 days and 28 days.
This experimentation process and its findings provide valuable insights into the effects of incorporating kotastone chips into concrete mixes.

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