

Experimental Investigation on Properties of Herbocrete by using Terminalia Chebula (Kadukkai)

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Abstract. Additives are ingredients and chemicals that are mixed into concrete to improve its fresh state and change its properties. The majority of admixtures are sold as chemical compositions on the market. These chemical admixtures are exceedingly costly and harm the environment significantly. Adding admixtures to concrete, on the other hand, is not a new notion; it has been used and developed in numerous countries in the past. In this project, we are investigating the possibilities of using natural materials like "Terminalia chebula" (Kadukkai). Terminalia chebula extract is added in different concentrations of 2.5%, 5%, 7.5% to the cement concrete, and its effects on the workability and strength of concrete are studied. Terminalia chebula when added to cement mortar does not affect however, it improves workability while also increasing compressive strength by 1.832 times of reference concrete. But the initial setting time of concrete is increased by 30 minutes of nominal OPC concrete.

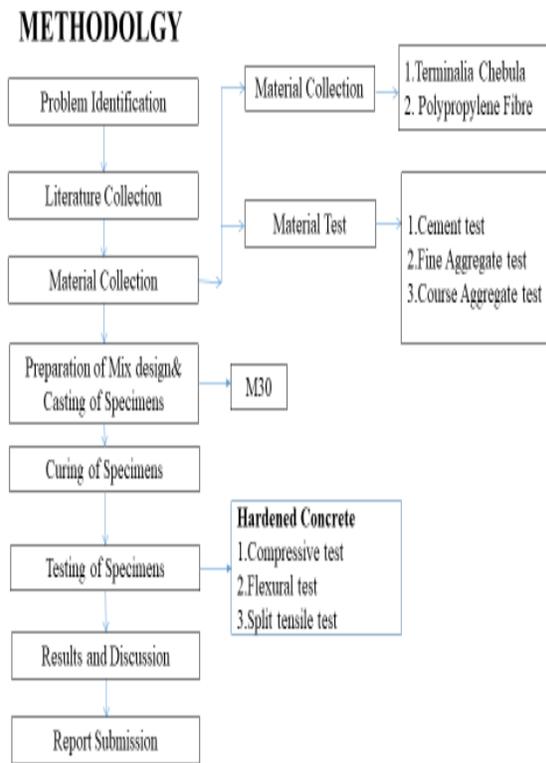
Introduction

India's building industry is the country's second largest. Chemicals have been used in construction in the past to improve the fresh condition and hardened qualities (maximum compressive strength). This has resulted in various types and quantities of contamination. For more than a century, our forefathers have employed numerous plants as an admixture in construction to increase the overall efficiency of the structure. Researchers want to look into the feasibility of employing They're put to the test on kadukkai-infused concrete specimens, which are then assessed for concrete mix, serviceability, and moisture. It had the best results when compared to the comparable coarse aggregate. Terminalia chebula was used as a concrete additive to create a greener, more environmentally friendly construction with enough quality and durability at a fair cost. Terminalia chebula does not affect the workability of cement mortar, however it does improve the compressive strength of reference mortar. To make the plaster, this mixture was combined with lime. Natural admixtures were used in both mortar and concrete as a result of this research review. I intend to test the Concrete's crushing, bending, and splitting tensile strengths were measured the 10 combinations of kadukkai and eggshell powder.

One of the approaches for improving the structural qualities of concrete is fibre dispersion. Polypropylene fibres are synthetic fibres that come from the textile industry as a waste product. They are inexpensive and come in a variety of aspect ratios. Inexpensive specific gravity and low cost are two properties of polypropylene fibres. Its application enables the material's natural tensile

and flexural strength to be reliably and effectively utilised, as well as a significant reduction in plastic shrinkage cracking and heat cracking. It protects the concrete structure from damage and avoids spalling in the event of a fire by providing reinforcement and protection. Pulling wires with a circular cross section or extruding plastic films with a rectangular cross section are used to make the fibres. Fibrillated bundles or monofilament are the two forms they take. The fibrillated polypropylene fibres are created by slitting a plastic film that has been divided into strips. The fibre bundles are fibrillated and sliced into predetermined lengths. When buttons are added to the ends of monofilament fibres, the pull-out load is increased.

Methodology



Material Used

Terminalia Chebula (Kadukkai):

Kadukkai is a fruit that can be height. It is used in the product of many herbal remedies for its good medicinal properties. It has extraordinary binding and hardened properties. Kadukkai can be used in construction only after it is made into a dried powder form for its effective usage. The dried kadukkai powder is mixed with sufficient water and enclosed for three days for making kadukkai paste. This paste is used for mortar preparation.

Polypropylene Fiber:

Polypropylene fibres have a tendency to keep the concrete mixture together. This decreases bleeding by slowing the settlement of coarse material. Slower bleeding equals slower drying, which means less plastic shrinkage breaking. Polypropylene fibres serve as crack stoppers in hardened concrete.

Experimental

Mixing Proportions:

The mix proportion for this study is 1:3 and it is the rich mortar ratio. The various proportions of natural admixtures like polypropylene fiber and kadukkai vary from 5% and 7.5%. Each proportion of cement mortar cast three specimens for testing.

Mixing, Casting, and Curing:

The required amounts of materials are taken as per the mix proportion. The natural admixtures like kadukkai paste were mixed with the water content for their effective usage. The percentage of natural admixtures added to the water content for the weight of fiber taken for the mortar. For the conventional mortar the desired quantity of cement is mixed with aggregates and water (Without Natural Admixtures), but for cement mortar, the quantity of 50% cement was replaced by the polypropylene fiber and they are mixed with fine aggregates(sand) and water. Then the fresh mortars were cast into 150mm cube molds for compression testing and were removed after 48 hours. The specimens were separated from the mold and were kept in water for 7-28 days for water curing. These steps are repeated for each proportion(5%, 7.5%) of cement mortar.

Result

Compressive Strength Test:

	No., of Days	Compressive Strength Test
5% of Kadukkai & 1% of PP	7	28.97 (N/mm ²)
7.5% of Kadukkai & 1.5% PP	7	27.95 (N/mm ²)
5% of Kadukkai & 1% of PP	14	36.59 (N/mm ²)
7.5% of Kadukkai & 1.5% PP	14	26.784 (N/mm ²)
5% of Kadukkai & 1% of PP	28	36.59 (N/mm ²)
7.5% of Kadukkai & 1.5% PP	28	26.784 (N/mm ²)

Split Tensile Test:

	No., of Days	Split Strength Test
5% of Kadukkai & 1% of PP	7	3.394 (N/mm ²)
7.5% of Kadukkai & 1.5% PP	7	4.38 (N/mm ²)
5% of Kadukkai & 1% of PP	14	3.368 (N/mm ²)
7.5% of Kadukkai & 1.5% PP	14	3.825 (N/mm ²)
5% of Kadukkai & 1% of PP	28	3.358 (N/mm ²)
7.5% of Kadukkai & 1.5% PP	28	3.938 (N/mm ²)

Flexural Strength Test:

	No., of Days	Flexural Strength Test
5% of Kadukkai & 1% of PP	7	3.358 (N/mm ²)
7.5% of Kadukkai & 1.5% PP	7	3.839 (N/mm ²)
5% of Kadukkai & 1% of PP	14	3.452 (N/mm ²)
7.5% of Kadukkai & 1.5% PP	14	3.512 (N/mm ²)
5% of Kadukkai & 1% of PP	28	3.363 (N/mm ²)
7.5% of Kadukkai & 1.5% PP	28	2.997 (N/mm ²)

Conclusion

- The addition of an additive to concrete changes the hardness and freshness of the material. The use of natural additive reduces CO₂ emissions from concrete and alters its mechanical performance. According to the findings, concrete with 5% Kadukkai and 1% PP had the highest compressive strength of 28.97 N/mm² after 7 days. After 28 days, the highest concrete with 5% Kadukkai and PP of fibre strength properties is 36.59 N/mm², according to the findings.
- After 7 and 28 days of fermentation with 5% Terminaliachebula extract and Polypropylene extract, the compressive strength increased by about 1.23 times that of reference concrete. When compared to a compressive strength of 5%, the compressive strength was lowered by 7.5 percent.
- The retarder is to blame for the 7.5 percent reduction in compressive strength. Natural admixtures are safe for the environment. When compared to chemical admixture, they were treated as emission admixture. It acts as a retarder in concrete, allowing it to adapt to hot climatic circumstances while maintaining the workability of the material.

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