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Use of Recycled Plastic and Coconut Shells in Concrete to Improve Strength

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Abstract: ***There is considerable imbalance in the conventional building materials; there is a great demand in recent past years. In quarries while cutting out the lateritic stone with help of cutting machines which produces 15-20% of soil wastes which poses a problem of disposal & utilizing the quarry waste. The quantity of plastic waste and waste from coconut in municipal solid waste collection is expanding rapidly ,the rate of expansion is double for every 10 years since plastic is non-biodegradable which remain on earth for 4500 years without degradation & it is a great challenge in disposing of waste plastics ,it is also danger in repeat recycling of plastic waste it poses a danger of being transformed to a carcinogenic materials & only a small amount of pet bottles are recycled, it has a many good characteristics such as versatility ,hardness, resist to chemical ,water impacts. In recent years, the natural sand is replaced by the m-sand, m-sand is also used in mixture of plastic & soil, in this work an attempt has been made to manufacture of blocks by using the waste plastic in range of 5-20% by weight of course aggregate. The blocks manufactured possess the properties such as neat & even-finishing with negligible water absorption & which satisfies the compressive strength to a certain extent. Tender coconut husk is biodegradable but it is hard husk. It takes a long time to degrade owing to its high moisture content and size. As the urban population takes to this healthy drink, especially during summers, the rising pile of leftover tender coconut husk is becoming a nuisance of sorts. The accumulation of husks in landfills or their burning release harmful pollutants, leading to soil and water pollution. Furthermore, the decomposition process contributes to greenhouse gas emissions, exacerbating climate change concerns.***

Keywords: Conventional, M-sand, Compressive Strength, Plastic Waste, Coconut Shell

I. INTRODUCTION

Recycled plastic waste and coconut shells can be used as sustainable alternatives to traditional materials, with coconut shells serving as a lightweight aggregate and recycled plastic potentially reinforcing concrete or forming other composite materials. Coconut shell can be used as lightweight concrete which can be used in non-load bearing structures, strip footings and non-structural elements. Environmental concerns can also be minimizing by making such sustainable efficient practices by the use of these waste coconut shell materials. Many researchers were started to use coconut shell as a coarse aggregate in replacement of conventional coarse aggregate for the concrete production. They all reported encouraged results on their respective parameters studies. Authors are aimed to group the findings of coconut shell concrete under one place. Study on different wastes as coarse aggregate in concrete for the benefit of Civil Engineering communities. The management and recycling of plastic waste is rapidly growing as it is a valuable resource of IT industries and it is very hazardous substances and with low recycling rate. The Utilization of plastic waste materials is a partial solution to environmental and ecological problems. As the use of plastic waste will reduces the aggregate cost and provides a good strength for the structures and road constructions. It will reduce the landfill cost and it is energy saving. An experimental study is made on the utilization of waste and coconut shell as a coarse aggregate in concrete with a percentage of 0 %, 25%, 35%, and 45% on the strength criteria of M45 Concrete. The feasibility of utilizing plastic waste and coconut shell aggregate as partial replacement of coarse aggregate has been presented.

II. METHODOLOGY

Study Area: To create coconut blocks incorporating recycled plastic and coconut shell, the methodology involves preparing the materials, mixing them in various proportions, moulding the mixture, and curing the blocks. The coconut shells, after being cleaned and dried, are crushed into desired particle sizes. Similarly, the recycled plastic, after sorting and cleaning, is shredded or chipped.

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These materials are then combined with a binder (cement or other suitable materials) in varying ratios to explore optimal performance. The mixture is then moulded into the desired block shapes using a suitable mould, and finally, the blocks are cured under controlled conditions to achieve the desired strength and durability.

1) *Material Collection and Preparation:*

- *Recycled Plastic:* Collect a variety of plastic waste, such as bottles, containers, and bags. Shred the plastic into smaller pieces, remove any labels or contaminants, and potentially sort by type for better processing.
- *Coconut Shells:* Collect mature coconut shells, ensuring they are clean and dry. The shells can be crushed into smaller pieces or left in their original shape, depending on the desired block design and the binder being used.

2) *Processing and Mixing:*

- *Plastic Processing:* The shredded plastic can be further processed into pellets or powder depending on the binder being used. It might involve melting the plastic and then cooling and shaping it or directly using the shredded material as a filler.
- *Binder Preparation:* The chosen binder (e.g., cement) needs to be mixed according to its manufacturer's instructions.
- *Mixing the Materials:* Combine the processed plastic, crushed coconut shells, and the prepared binder in the desired proportions. This process can be done manually or mechanically, ensuring uniform distribution of the components.

3) *Moulding and Curing:*

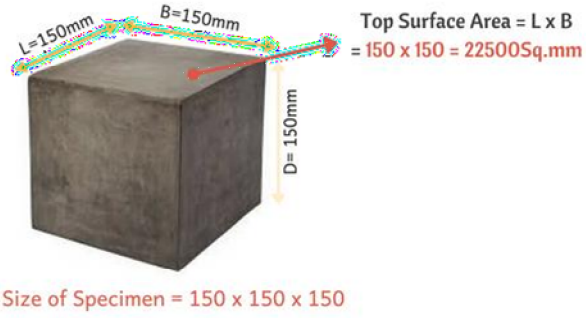
- *Block Moulding:* The mixture is then transferred into moulds of the desired shape and size. The moulds can be made from metal.
- *Curing:* After the blocks are moulded, they are allowed to cure for a specific period (e.g. 7, 14,21days) to allow the binder to harden and the mixture to achieve its desired strength and durability. This can involve keeping the blocks in a controlled environment to prevent moisture loss and ensure proper setting.

4) *Testing and Quality Control:*

- Strength Testing: The cured blocks can be subjected to various tests to evaluate their compressive strength, density, and other relevant properties.

III. MODELLING AND ANALYSIS





Compressive strength of Concrete Formula: The Compressive strength of specimen can be calculated by dividing maximum load carried by the specimen by cross-sectional area of the specimen cubes.

The surface area of specimen: = 150mm x 150mm = 22500mm² = 225cm²

Assume, The Max compression load is 450KN 1KN = 1000N

450KN = 450×1000 = 450000N

So, Compressive Strength of Concrete = 450000 /22500 = 20N/mm² = 203Kg/cm²

IV. RESULT AND DISCUSSION

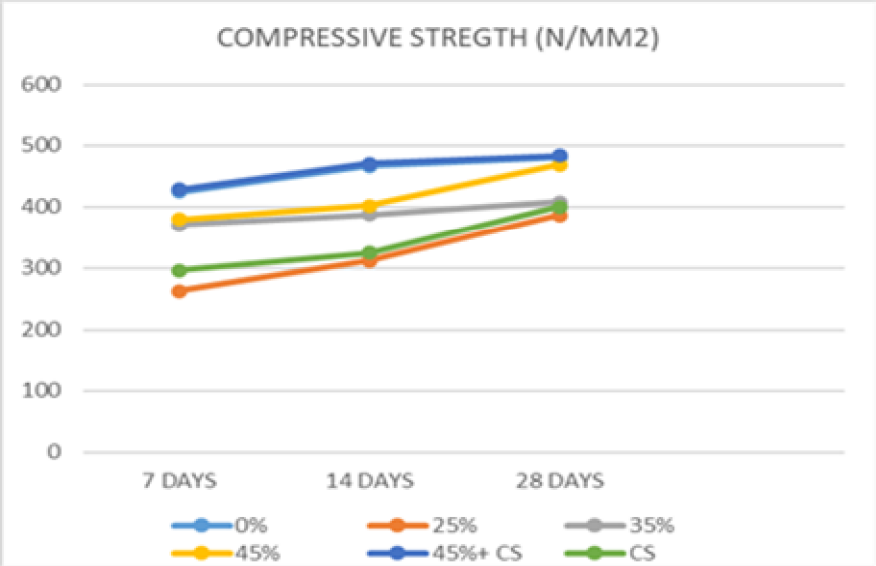


Fig . Compressive Strength Vs Days

1) Compressive strength for No replacement after 28 days = 480 N/mm^2
2) Compressive strength for 25% replacement of plastic waste after 28 days = 386 N/mm^2
3) Compressive strength for 35% replacement of plastic waste after 28 days = 408 N/mm^2
4) Compressive strength for 45% replacement of plastic waste after 28 days = 469 N/mm^2
5) Compressive strength for 45%+ COCONUT SHELLS replacement after 28 days = 483 N/mm^2
6) Compressive strength for COCONUT SHELLS replacement after 28 days = 400 N/mm^2

V. CONCLUSIONS

In this research, compressive strength has been investigated for various types of concrete containing 25%, 35%, 45% , 45% + Coconut Shell and only Coconut Shell proportion of waste plastic aggregate by volume of course aggregate.
The following conclusions can be drawn based on the above report:

- The compressive strength of concrete containing different proportion of waste plastic and Coconut Shells was different but the compressive strength at 45%+ Coconut Shells volume of course aggregate provided higher strength which allowed it to be used in structural application.
- Plastics can be used to replace some of the aggregates in a concrete mixture. This contributes to reducing the unit weight of the concrete. This is useful in applications requiring non-bearing lightweight concrete, such as concrete panels used in facades.
- High-quality plastic concrete, which possess standard shape, sharp edges, smooth surfaces, high durability, and great strength, can be used for temporary structural construction such as roads prepared during construction work, parking tiles, etc.
- Mainly, all the above are concluded that the waste plastic are used in concrete mix with different ratios. In this process to reducing constructional cost, reducing the environmental pollution and some of the general disposal methods are reduced.

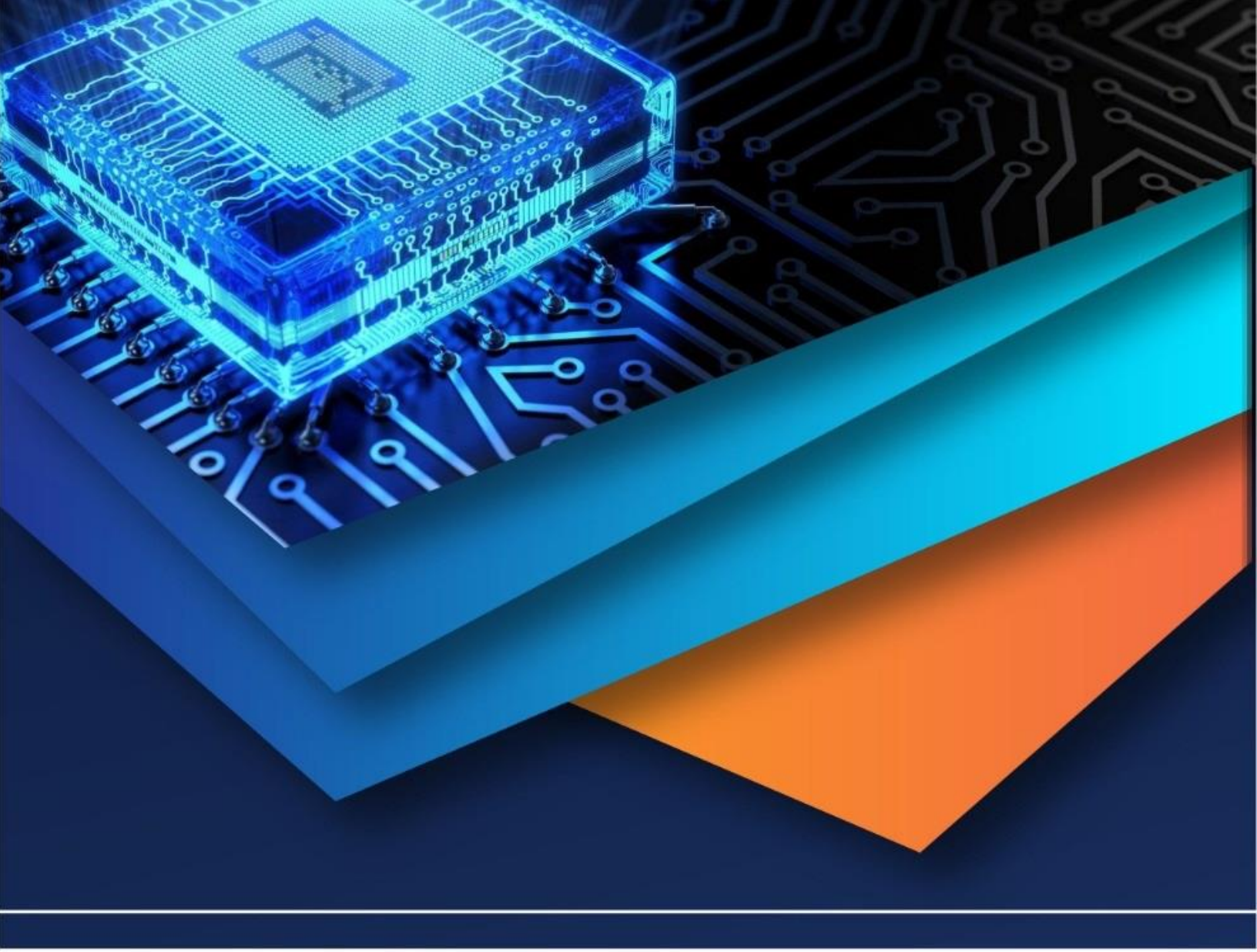
Concrete of 45%+ Coconut Shells which possess standard shape, sharp edges, smooth surfaces, high durability, and great strength, can be used for bricks, compound walls, non-structural members, etc

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