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Characterization of Concrete by Adding Chopped Glass Fiber and Coir Fibre Ash by replacing cement -A Review

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Abstract: *Use of waste materials for producing concrete for the construction of civil structures is a topic of significant concern. Mixing of supplementary materials in concrete and mortar affects its strength parameters, workability and other physical and chemical properties. Some pozzolanic materials which by themselves have no binding properties, when used with Portland cement show cementitious properties. There are threefold benefits of using supplementary materials in cement and concrete. First advantage is the financial saving obtained by replacing a considerable part of the Portland cement by an economical, waste, industrial byproduct. Second one is the reduction of the blended cement environmental cost associated with the greenhouse gases emitted during Portland cement production. The last advantage is the increased performance of the end product. Partial replacement of Portland cement in concrete reductions the quantity of Portland cement. This decreasing in cement amount further reductions the manufacturing cost and thus reduces the waste emissions such as carbon dioxide (CO_2) emission. This also, reduces the energy consumption and thus, decreases the rate of global warming. From previous researches, it has been observed that fly ash boosts the compressive strength and workability of concrete. Fly ash and natural fiber is also a waste material, which has some significant properties than can be modified the properties of concrete. It has been noted that coconut fibre increases compressive strength of concrete for a certain ratio. If both materials are used together into concrete, significant modifications may be noticed in the properties of concrete. In the present work, fly ash and coconut fibre are used into concrete as a partial replacement of cement for observing their effect and compare with normal concrete in terms of workability and compressive strength.*

Keywords: *Waste material, Pozzolanic, Portland cement.*

1. Introduction

Use of waste materials for producing concrete for the construction of civil structures is a topic of significant concern. Mixing of supplementary materials in concrete and mortar affects its strength parameters, workability and other physical and chemical properties. Some pozzolanic materials which by themselves have no binding properties, when used with Portland cement show cementitious properties.

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From previous researches, it has been observed that fly ash boosts the compressive strength and workability of concrete. Fly ash and natural fiber is also a waste material, which has some significant properties than can be modified the properties of concrete. It has been noted that coconut fibre increases compressive strength of concrete for a certain ratio. If both materials are used together into concrete, significant modifications may be noticed in the properties of concrete. In the present work, fly ash and coconut fibre are used into concrete as a partial replacement of cement for observing their effect and compare with normal concrete in terms of workability and compressive strength.

2. Related Work

The relevant literature pertaining to the use of supplementary products in concrete carried out in India and abroad has been reviewed and presented as under:-

Ade and Aina (2015) conducted an experimental investigation on thermal effect of using coir fibre and polypropylene fibre on concrete. Cubes were kept at temperatures 200, 400, 600 and10000Cand checked the effect of temperature on the strength of concrete at 7, 14, 21, and 28 daysof curing. It has been found that coir fibre increases compressive of concrete and also fire resistance property of the concrete more than polypropylene fibre.

An experimental study has been performed by Sukumar and John (2014) for utilizing steel fibre in the concrete. It has been found that steel fibre give better strength as compared to polypropylene fibre and ductility of the concrete also enhanced.

Ealis et al. (2014) conducted an experimental study on the concrete by adding coconut shell, fibre with partial replacement of fly ash. They replaced coconut shell and coir fibre with the coarse aggregate. Comparative study has been done for compressive strength, tensile strength, chemical resistance, electrical resistance and ph value of the concrete. It has been found that the use of coconut shell and coir fibre decreases strength of concrete.

Magnani et al. (2014) did theoretical studied several types of fibres and observed their effects on the concrete. Compressive and tensile strength of concrete has been checkedwith replacement of rice husk ash and coir fibre. Finally, came to a conclusion that rice husk ash and coir fibre increases the tensile and compressive strength of concrete and make concrete more economical.

Nikhil et al (2014) experimentally proved that water quality effects compressive strength of concrete. It has been noted that the PH value of water is inversely related to the strength of the concrete i.e.as PH of water increases withstrength of decreases and vice versa.

Wankhede et al. (2014) discussed the effects of fly ash in concrete and found that 10 and 20% replacement of fly ash shows very good result in case of compressive strength for 28 days but at 30% replacement of fly ash shows ultimate strength of compressive strength.

Pitroda (2014) replaced cement with fly ash in 0, 10, 20, 30 and 40 % by the weight of the cement in M25 and M40 grade of concrete and shows that as the fly ash replacement with cement increases, compressive strength of concrete decreases.

Obilade and Olutoge. (2014) conducted an experimental study by utilizing oil palm stem into the concrete. Different test on concrete like compressive, flexural, spilt tensile testing have been conducted and found that oil palm stem increased the load bearing capacity of the concrete and compressive strength of the concrete.

Kiran and Ratnam (2014) conducted an experimental investigation by partly replacing cement with fly ash and studied parameters such as durability, sulphate attack of the concrete and found the effect of fly ash on the concrete. Durability of the fly ash based concrete has increased.

A comparative experimental study has been done by adding coir fibre and polypropylene woven fibre by Khatri (2014) and found that compressive strength increases more in case of M20 grade rather than M40 grade of concrete. Finally, concluded that coir fibre with admixture provide more compressive strength than polypropylene woven fibre.

Muthukumar et al (2014) utilized coconut shell powder and groundnut shell powder and mixed them into the concrete and observed the effect of on the concrete strength and found that maximum tensile strength, flexural strength obtained at 40% and 50% adding of coconut shell powder and groundnut shell powder by volume of concrete respectively.

According to Ruben and Bhaskar (2014), by increasing coir fibre content the compressive strength increased up to certain level. Coir fibre decreases environmental pollution and also improves the resistance to sulphate attack.

An experimental investigation has been done by replacing fly ash with cement by the ratio of 20, 40, and 60 % on M15, M20, M25 grades of concrete by Jatale et al. (2013).Outcomes showed that workability improved, density and air content of concrete remains unaffected, bleeding and shrinkage of concrete decreased, durability

improved, modulus of elasticity reduced and compressive strength of concrete reduced as fly ashincreased.

Alani et al. (2013)presented an experimental study by using different type of steel fibre in the concrete and investigated their effect on the concrete properties. 9 cube specimens were made for testing compressive strength at 7, 14 and 28 days and cylinders were made for computing split tensile strength and beams for flexural strength. Same results were found in both cases.

Nagalakshmi (2013) studied the effects of replacement of fly ash and coconut shell. 20% Fly ash replaced with cement and coarse aggregate with coconut shell by 10%, 20% and 30% partially and concluded that with increasing percentage of coconut shell the strength get reduced.

According to Ramkrishna and Sudaranjan, coconut fibre increases the impact resistance of concrete by 3-18 times.

The effect of fibre length and sodium hydroxides on impact strength of the coconut fibre has been studied by Kartikeyan and balamurugan (2012). Different percentage of sodium hydroxide (i.e. 2, 4, 6, 8 and 10%) has been taken. It has been observed that alkali treated coir fibre with 30 mm length shows very good impact strength than other coir fibre specimens. Addition of 6% concentration sodium hydroxide shows better impact strength.

3. Conclusion

From the above study it may be concluded that the use of Chopped glass fibre and steel fiber in the concrete which is generated from industrial activities in urban areas construction material. alkali treated coir fibre with 30 mm length shows very good impact strength than other coir fibre specimens. with using coir fiber in concrete, the strength gets reduced but using this material concrete is used in temporary structures. Using steel fiber the compressive strength as well as split tensile were found same.

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