IOSR Journal of Engineering (IOSR JEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
PP 18-21

Experimental Study on Polypropylene Fibre Reinforced Concrete Using Steel Slag as a Partial Replacement of Cement

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***Abstract*:** *The major problem the world is facing today is the environmental pollution. In the construction industry mainly the production of Portland cement will causes the emission of pollutants results in environmental pollution. We can reduce the pollution effect on environment, by increasing the usage of industrial by-products in our construction industry. Geo-polymer concrete is such a one and in the present study, to produce the geo-polymer concrete the Portland cement is fully replaced with steel slag and alkaline liquids are used for the binding of materials. The alkaline liquids used in this study for the polymerization are the solutions of Sodium-hydroxide (NaOH) and sodium silicate (Na2Sio3). This study investigates the use of steel slag in 50% replacements by mass in cement. And the polypropylene fiber is added as 0.5%, 1% and 1.5%. Harden concrete properties like compressive strength, Splitt tensile, flexural strength of concrete are be determined for Geoplymer concrete and Normal concrete. Finally the test results were compared from the test results, it has been observed that the geo-polymer concrete possess better result than the normal concrete.*

I. Introduction

Concrete made with Portland cement has certain characteristics. It is relatively strong in compression but weak in tension and tends to be brittle. These two weaknesses have limited its use. Another fundamental weakness of concrete is that cracks start to form as soon as concrete is placed and before it has properly hardened. These cracks are major cause of weakness in concrete particularly in large onsite applications leading to subsequent fracture and failure and general lack of durability. The weakness in tension can be overcome by the use of conventional rod reinforcement and to some extent by the inclusion of a sufficient volume of certain fib res.Fib res reinforced concrete can be defined as a composite material consisting of mixtures of cement, mortar or concrete and discontinues, discrete, uniformly dispersed suitable fib res. And fib res is a small piece of reinforcing material possessing certain characteristics properties. They can be circular or flat the fib res is often described by the parameter aspect ratio which is ratio of fib res length to its diameter. Typical aspect ratio varies from 20 to 150.The use of fib res to reinforce a brittle material was done first by Egyptians they used straw to reinforce sun baked bricks and horsehair was used to reinforce plaster. In the early 1900's asbestos fib res were used in concrete. The modern development of steel fib res reinforced concrete may have begun in 1960's. Glass fib res comes into picture by the 1980's and Carbon fib res from 1990's. And now a day's many types of fIb res are available as a construction material.

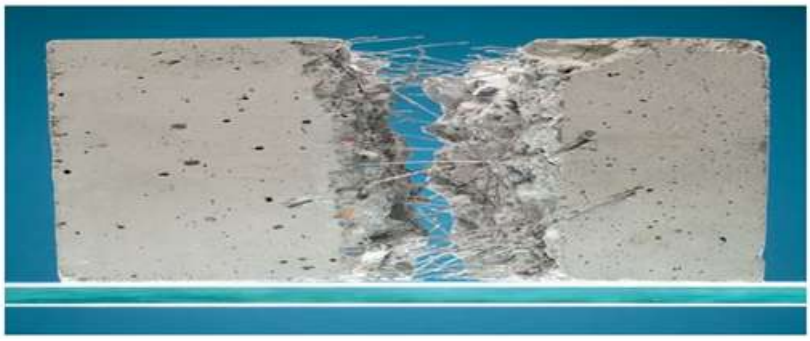

Figure 1.1: Fibre Reinforced Concrete

Types Of Fibers

Depending upon the parent material used for manufacturing fib res can be broadly classified as;

1. Steel fib res (e.g. low carbon steel , stainless steel, galvanized iron, aluminium)
2. Mineral fib res (e.g. asbestos, glass, carbon)
3. Synthetic fib res (polyester, nylon, polypropylene, polyethylene)
4. Natural fib res (bamboo, coir, jute, sisal, wood, sugarcane bagasse).

II. Proposed System

Steel Fibres-Reinforced Concrete:

Steel fibres-reinforced concrete is basically a cheaper and easier to use form of rebar reinforced concrete. Rebar reinforced concrete uses steel bars that are laid within the liquid cement, which requires a great deal of preparation work but make for a much stronger concrete. Steel fibre-reinforced concrete uses thin steel wires mixed in with the cement. This imparts the concrete with greater structural strength, reduces cracking and helps protect against extreme cold. Steel fibres is often used in conjunction with rebar or one of the other fibres types.

Figure 1.2 Steel Fib res

Glass Fibre Reinforced Concrete:

Glass fibre-reinforced concrete uses fiberglass, much like you would find in fiberglass insulation, to reinforce the concrete. The glass fibre helps insulate the concrete in addition to making it stronger. Glass fibre also helps prevent the concrete from cracking over time due to mechanical or thermal stress. In addition, the glass fibre does not interfere with radio signals like the steel fibre reinforcement does.

Figure 1.3 Glass Fib res

Synthetic Fibbers:

Synthetic fib re-reinforced concrete uses plastic and nylon fib res to improve the concrete's strength. In addition, the synthetic fib res have a number of benefits over the other fib res. While they are not as strong as steel, they do help improve the cement pump ability by keeping it from sticking in the pipes. The synthetic fib res do not expand in heat or contract in the cold which helps prevent cracking. Finally, synthetic fib res help keep the concrete from spelling during impacts or fires.

Nylon Fibre

Natural Fibre Reinforced Concrete:

Historically, fibre-reinforced concrete has used natural fibres, such as hay or hair. While these fibres enhance the strength of concrete they can also make it weaker if too much is used. In addition, if the natural fibres are rotting while being mixed, then the rot can continue even while in the concrete. This eventually leads to the concrete crumbling from the inside which is why natural fibres are no longer used in construction.

Jute Fibre

Polypropylene Fibers:

- Polypropylene fibers are hydrophobic, that is they do not absorb water. Therefore, when placed in a concrete matrix they need only be mixed long enough to insure dispersion in the concrete mixture.
- The mixing time of fibrillated or tape fibers should be kept to a minimum to avoid possible shredding of the fibers. The type of polypropylene fiber recommended by manufacturers for paving applications is the collated fibrillated fiber. The length of fiber recommended is normally tied to the nominal maximum size of aggregate in the mixture.
- Manufacturers recommend that the length of the fiber be greater than twice the diameter of the aggregate. This would be consistent with past experiences with steel fibers and also with current theories on fiber dispersion and bonding".

Polypropylene Fibers

III. Conclusion

The study on the effect of 50% replacement of cement by steel slag with fibrillated Polypropylene Fibers with different cut length can still be a promising work as there is always a need to overcome the problem of brittleness of concrete. Compressive strength increases with the increase in the percentage of Polypropylene fibre up to 1% addition of Cement in Concrete for different mix proportions.Polypropylene fibre can be used for increasing the strength of concrete with partial addition of cement. The workability of Polypropylene fibre concrete has been found to decrease with increase in Polypropylene fibre content replacement.Polypropylene fibre is Reduce number of joints And Reduce repair due to subsequent damage. Used of long fiber with same volume of fraction gives maximum split tensile strength over fiber short cut length.