Enhance the engineering properties of composites using slag and waste material: A Review

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Abstract In this review an attempt was made to analysis the properties of concrete by incorporation the waste material. Slag, polymers, flyash, rice husk were used in the concrete as waste material. The flyash and slag enhance the compressive strength of concrete and the polymers enhance the breaking strength of concrete. The marble dust waste product of marble industry used in the concrete. The use of marble dust decreases the workability and enhances the compressive strength. The ratio of slag was used 5 to 30% in concrete after increasing the quality of slag not gives satisfactory results. The waste material such as GGIFS gave good results in the incorporation with alkali (NaOH).

Keywords —Fly ash, cement, slag, composite, concrete, compressive strength

I. INTRODUCTION

The unprecedented scale of global climate change triggered by industrialization and urbanization has catastrophically ravaged our ecosystem. While industries are vital for economic prosperity and progress, their deleterious consequences on the environment are alarming. Industrial byproducts have drastically degraded our ecological balance, compromising agricultural productivity and water resources, and contaminating the air we breathe [1,2].

Furthermore, the exponential growth of the concrete industry to cater to escalating human demands has concurrently inflicted detrimental environmental consequences [1,2]. In recent years, researchers have exhibited a burgeoning interest in developing and accessing the mechanical properties of fiber-reinforced recycled thermoplastic and thermoset resin composites, which are fabricated from non-biodegradable and non-renewable plastics constituting a substantial proportion of discarded solid waste. This review article provides a comprehensive overview of these advancements, with a particular focus on recycled thermoplastic matrix composite materials [3]

Mechanical properties of composite enhance by using polymer and slag as reinforcement. The load carrying capacity was increase at 5% of slag used and the tensile strength was increased at 15% of polymer used. [4] Slag affected the strength and microstructural characteristic of Concrete. [5] Waste material used in the polymer concrete. The slag and other waste material used for manufacturing the geopolymer concrete.[6]

Table 1: Literature review on different existing research

Sno.	Author	Title	Description
1	Y. Zhang,etall.[7]	Effect of Waste Glass Powder on the Mechanical Properties of Polymer Composites	The author investigated the properties of concrete by using the glass powder.
2	A. K. Gupta etall.[8]	A Review on the Use of Waste Materials in Composite Materials	The author given the review that the slag material suitable in the concrete.
3	R. K. Singh etall[9]	Use of Slag in Composite Materials for Sustainable Construction	Author describe the use of slag is good for sustainable construction material
4	K. Anand Babu etall[10]	Enhancing the Engineering Properties of Composites Using Slag and Waste Material	The engineering properties of concrete enhance by using the slag and waste material.
5	H. Y. Wang etall [11]	Investigation on the Mechanical Properties of Slag-Reinforced Epoxy Composites	Epoxy material suitable for the construction material

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II. MATERIAL USED

a) Cement: Various studies have reported different factors like types of cement, grade of cement. The engineering properties are also affected by the chemical composition of the slag. Other Portland cement was used in partially replacement. Table no 2 represent the ingredients of cement:

Ingredients	Percentage
Lime (CaO)	60 to 70
Silica (SiO2)	17 to 25
Alumina (Al2O3)	3 to 8
Iron oxide (Fe2O3)	0.5 to 6
Magnesia (MgO)	0.1 to 4
Sulphur trioxide (SO3)	1 to 3
Soda and/or Potash (Na2O+K2O)	0.5 to 1.3

b) Aggregate: Local available Fine and coarse aggregate were used in the existing research

Fig 1 is representing the origin of slag.

c) Water: Available water having pH 6.5 to 7.5 may be used.

d) Waste material: from steel factor, thermal power plant and other industry may be used. The replacement quantity is depend on the chemical composition of the waste material quantity.

e) Flyash: Fly ash is made up of fine, powdery particles that are mostly spherical in shape. It can be solid or hollow, and is mostly amorphous in nature. The specific gravity of fly ash is usually around 2.0, but can vary from 1.6 to 3.1. Fly ash can be grey in color. The flyash comes from thermal power plant having Cementitious properties because Class C fly ash generally contains more than 20% lime (CaO).

Fig 2 is representing the origin of flyash

f) Slag: is the industrial waste. Mostly waste from steel industry used as slag.

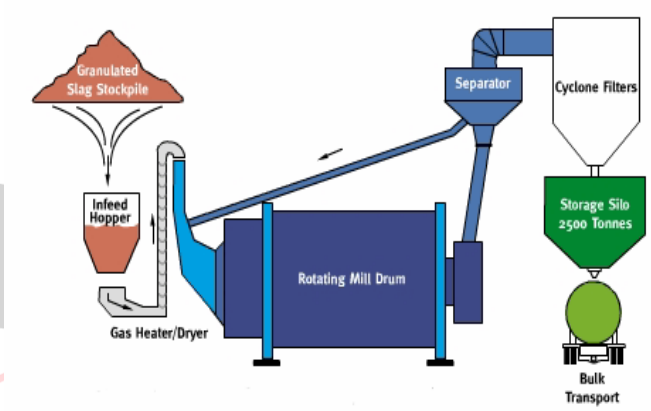

Fig 3is representing the origin of slag.

Effect of slag on the workability of concrete and Mortar *Wood (1981) observed that the fluidity and placability of concrete incorporating Ground Granulated Blast Furnace (GGBF) slag exhibited enhanced properties compared to concrete without GGBF slag. He attributed this improvement to the surface topology of GGBF slag, which generated sleek friction-reducing interfaces within the cement*
paste.

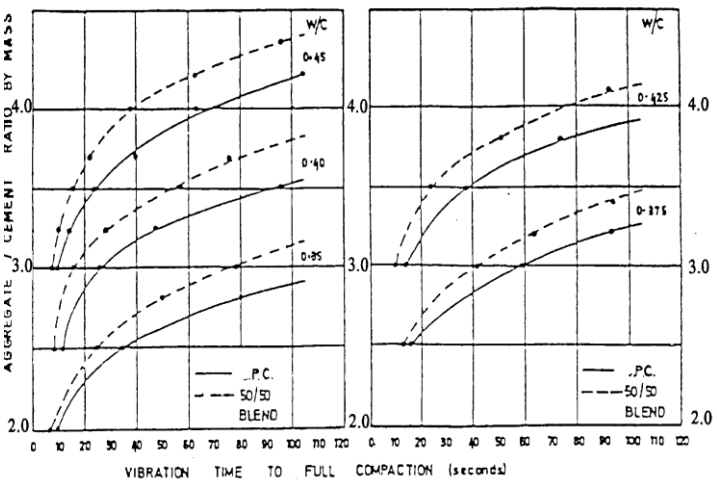

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Fig. —Relationship between responses to vibration of concrete mixtures made with Portland cement was blended with a composite mixture comprising 50 percent Ground Granulated Blast Furnace (GGBF) slag

III. Conclusion

- The waste material may be used in the construction material.
- The waste material used as partially replacement of cement if having binding properties.
- The flyash from thermal power plant given the best result in the engineering properties.
- The slag from the steel industry used in the concrete.
- The fly ash up to 20% replacement with cement gave best result in compressive strength.
- Ground granulated blast furnace slag (GGBFS) has been used as supplementary cementitious material.
- The slag give the best result at 12% of replacement with cement after the increasing the quantity of slag leads to decrease the compressive strength

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