PARTIAL REPLACEMENT OF CEMENT USING IRON SLAG,STARCH AND FLY ASH

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**ABSTRACT**

The construction industry is continuously seeking sustainable alternatives to traditional cement due to the environmental impact of cement production, including high energy consumption and CO2 emissions. This study explores the potential of using a combination of iron slag, starch, and fly ash as partial replacements for cement in concrete production. Iron slag, a by-product of steel manufacturing, while fly ash, a waste material from coal combustion, has been widely used as a supplementary cementitious material. Starch, a biodegradable polymer, was incorporated to enhance the workability and bonding properties of the mix. The effects of varying proportions of iron slag, starch, and fly ash on the mechanical properties compressive strength of the concrete were investigated. The results demonstrated that the combination of these materials could effectively reduce the environmental footprint of concrete production without compromising the strength and durability of the material. This study highlights the potential for these industrial by-products to contribute to more sustainable construction practices, reducing the reliance on virgin cement and minimizing waste generation

**INTRODUCTION**

The project explores the development of an alternative material for cement production by utilizing industrial by-products such as iron slag, starch, and fly ash.

• These materials are abundant, cost-effective, and environmentally sustainable, offering potential solutions to reduce the carbon footprint associated with traditional cement production.

• Iron slag, a by-product of steel manufacturing, can serve as a partial replacement for clinker, while fly ash, a waste material from coal combustion, is rich in silica and alumina, which can enhance the binding properties of the mixture. Starch, a biodegradable and renewable resource, can act as a binder, improving the workability and strength of the material. By combining these materials, the project aims to create a sustainable alternative to conventional cement, contributing to waste reduction and offering a greener construction material

**OBJECTIVES**

• To Promotes eco-friendly construction by reducing CO₂ emissions and utilizing industrial/agricultural waste.

• to Reduce reliance on costly raw materials by reusing byproducts like fly ash and slag.

• Enhances durability, thermal insulation, and workability, paving the way for advanced construction technologies

**LITERATURE STUDY**

strength properties and micro-structural analysis of self-compacting concrete made with iron slag as partial replacement of fine aggregates

by R afat Siddique Ph.D

Mixed Concrete Optimization using Fly Ash, Silica Fume and Iron Slag on the SCC's Compressive Strength by D. Raharjo

**MIX RATIO**

• Slag 20%

• Flyash 20%

• Starch 10%

• Cement 50%

**COMPRESSIVE TEST**

Compression testing of the cube specimens was carried out in a Universal Testing Machine of capacity 2000 kN, as per IS: 516 1959. The load was applied without shock at a rate of 140 kg/sq.cm/min. A set of three cubes were tested for each of the mix for their compressive strengths at 7 and 28 days of curing. As expected, the normal weight concrete has more compressive strength at all ages compared to lightweight concrete. At 28 days, it was found that compressive strength of 5%, 10% EPS based concretes compared to normal concrete

TEST RESULT ANALYSIS FOR IRON SLAG MATERIALS DAY 3 DAY 7 DAY 14 DAY 28 COMPRESSIVE STRENGTH (mpa) 35,424 44,418 57,655 61,303

**FUTURE SCOPE**

• Promotes eco-friendly construction by reducing CO₂ emissions and utilizing industrial/agricultural waste.

• Reduces reliance on costly raw materials by reusing byproducts like fly ash and slag.

• Material Performance: Enhances durability, thermal insulation, and workability, paving the way for advanced construction technologies.

• Opportunities to explore hybrid combinations for tailored properties in specific applications.

• Increasing demand for green materials may drive regulatory support and market adoption.

**APPLICATION**

• Eco-friendly concrete for residential, commercial, and industrial projects. • Roads and bridges with improved durability and reduced environmental impact.

• Pavers, tiles, and blocks utilizing sustainable cement alternatives.

• For non-load-bearing walls using starch for enhanced workability and insulation.

**CONCLUSION**

The use of iron slag, starch, and fly ash as alternative materials for cement presents a sustainable and cost-effective solution for reducing environmental impact. These materials improve concrete performance, enhance durability, and promote the circular economy by utilizing industrial and agricultural waste. With ongoing research and support from green construction policies, this approach holds significant potential for widespread adoption in future construction practices.

**REFERENCE**

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