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Micro and mechanical behaviour of Treated Used Foundry Sand concrete

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HIGHLIGHTS

- To minimize the iron content; the Used Foundry Sand (UFS) was treated with acid.
- By treating, silica in sand enriched is called as Treated Used Foundry Sand (TUFS).
- To assess properties of concrete; fine aggregate was partially replaced with TUFS.
- TUFS shows enhanced properties in mechanical and micro studies.

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ABSTRACT

Used Foundry Sand (UFS) is the high quality silica sand by-product from the production of both ferrous and nonferrous metal casting industry. The UFS from ferrous metal casting industry contains more iron content. Inclusion of UFS without proper treatment in concrete will reduce the binding and strength properties. In order to minimize the iron content, the UFS was treated with acid. While treating with acid, the silica in foundry sand has been enriched. This is called as Treated Used Foundry Sand (TUFS). This paper presents the results of experimental investigation carried out to evaluate the microstructural and mechanical properties of concrete mixtures in which fine aggregate (river sand) was partially replaced with TUFS. Test results indicated a marginal increase in the strength properties and good microstructural properties of plain concrete by the inclusion of TUFS as partial replacement of fine aggregate (sand). This will pave the way for making good quality concrete and disposing the Used Foundry Sand safely without disturbing the environment.

1. Introduction

Concrete is the most widely and popularly used construction material in construction industry. Slightly more than a ton of concrete is being produced every year for every human being on the planet. Over past several decades, the demand for concrete has been increasing rapidly due to infrastructure development. The concrete constitutes various ingredients like cement, fine aggregate and coarse aggregate. Out of these, river sand is used as a fine aggregate in concrete production for several decades. The demand for river sand is increased due to depletion of sand. At present, many researches are being carried out to overcome the stress and demand for river sand by using alternative materials like foundry sand, fly ash, bottom ash and slag which can result in significant improvement in overall energy efficiency and environmental performance.

Foundry industry produces a large amount of by-product material during casting process [1] which is a high quality silica sand. It is a by-product of ferrous and nonferrous metal casting industries. Foundry industries reuse the sand many times and after many cycle it is removed and disposed to nearby sites. This waste sand from foundry is termed as Used Foundry Sand (UFS). The physical and chemical characteristics of foundry sand depend on the type of casting process and the nature of industry from which it originates. The automotive industries are the major generators of foundry sand.

Like many waste products, foundry sand also has some valuable applications to other industries. In Tamilnadu, approximately 200 tons of sand is used in the production annually of which 20 tons are discarded and are available to be recycled into other products [3]. Many foundries dump the waste in nearby vacant area which causes pollution and environmental degradation.

Hence various researches are in progress to effectively utilize the Used Foundry Sand in concrete. Siddique et al. [1] investigated abrasion and strength properties of concrete containing

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