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Effectiveness of industrial waste materials used as ingredients in fly ash brick manufacturing

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ABSTRACT

Flyash is waste industrial by-product from thermal power plants used as a raw material for Brick manufacturing. These Flyash bricks are proposed as an alternative to the conventional burnt clay bricks avoiding the consumption of clay to ease the stress on an exhaustible resource which also threatens the sustainability of our environment. But flyash as a material has its own problems as well as lot of stress on one material could lead to demand ultimately affecting the construction industry. To negate this prospect several industrial waste materials such as Ground granulated blast-furnace slag (GGBS), Granite powder (GP), Foundry sand (FS), Bottom ash (BA), Bagasse ash (BHA), Steel slag (SS), Quarry dust (QD) and Rice husk ash (RHA) which are considered environment friendly are chosen to partially replace flyash in flyash bricks. This would surely reduce the consumption of flyash thus leading to conservation. The selected industrial waste materials are replaced at 25%, 50%, 75% and 100% separately. The casted specimen along with a control specimen is tested for their compressive strength, water absorption and efflorescence. As bricks are generally compressive members and their moisture content affects both the strength and durability. Efflorescence indicate the presence of salts and water absorption shows the moisture content of the brick. Thus, the brick specimen are tested for the above-mentioned tests and the results are recorded. 100% replacement of the waste materials in FA bricks can be achieved using the mixes GGBS, GP, FS, BHA, SS and QD for safe waste disposal and use of important minerals in waste materials in view of compressive strength. Average water absorption for all the waste material mixes in bricks was lower than the limit specified in IS code. Bricks with replacement of SBA and RHA represent nil and slight efflorescence respectively. The efflorescence of FS mix bricks is nil for all the percentage replacement as the calcium oxide and ferric oxide percentages in FS is way lower than the FA Bricks. This research findings could broaden the perspective of replacement of flyash in flyash bricks and enhance their effectiveness.

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1. Introduction

Bricks are an important construction material for almost 5000 years in human history. Bricks belong to the category of Masonry structures and remains common cost-effective way of construction even today. Brick as a construction material, didn't lose its significance like stones. Bricks are produced by burning dried hardened clay blocks. Burnt clay bricks remained a primary construction material for all ancient civilizations. Brick masonry

was considered important because of several favourable features such as its ease of construction, high durability, easy manufacturing (clay is easily available for brick manufacture), thermal properties, etc. Clay was an easily available raw material in olden times. But population burst in our society has caused a high demand which has resulted in exploitation of this resource. Additionally, the brick production process involves burning which has high carbon footprint and has become a concern as carbon emissions across the world hike and its effects have started to give profound impacts in day to day life of the people.

Alternatives to Bricks are being proposed and used for centuries and several other materials have also been in the table for years.

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