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A BRIEF REVIEW OF THE SUGARCANE BAGASSE ASH AS PARTIAL REPLACEMENT OF CEMENT WITH SINTERED EARTHEN BLOCKS OF FIBER-REINFORCED CONCRETE.

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ABSTRACT

This review article will examine how solid waste may be utilized, which is formed from the production of sugar factories, as well as how sintered earthen blocks can be used to replace coarse aggregate, which is made in large amounts in India. These materials are the ones that are generated in vast numbers in India. It has a very high silica content, which enables it to perform the essential function of an efficient pozzolan material, which in turn leads to an improvement in the cementitious materials and makes them appropriate for use as binding materials in the construction of buildings using a variety of mixes of concrete. Ash from sugarcane bagasse, which is a waste of product, is used for solutions in waste management that are both viable and cost efficient. According to a number of studies that were conducted, increasing the replacement percentage of cement in a mix while also increasing the amount of coarse aggregate resulted in a stronger end product that was also more durable. In today's world, waste materials are frequently used into the process of preparing ordinary concrete that is suited for use in mass building. In the study that is being presented, this category of waste materials is being deemed to be the third largest material utilised by human beings, after only food and water. In addition to the destruction of forests and the combustion of fossil fuels, the production of cement by industry is a source of carbon dioxide emissions. In conclusion, sugarcane bagasse ash has not only enhanced performance in the majority of the cases, but it has also decreased the cost of the material. This leads to the conclusion that sugarcane bagasse ash is acceptable for mass concrete, which is a true and incredibly valuable option for waste management as well as cost economy.

Keywords:Sugarcanebagasse,sinteredearthblocks,Concrete,wastesteelfiberandstrengthenhancement.

1. INTRODUCTION

The production of steel results in the generation of a number of by-products, one of which is known as steel slag. It is a ceramic substance that is non-metallic, and it is produced when fluxes like calcium oxide react with the inorganic non-metallic components that are found in steel waste. The use of steel slag as a constructional material minimizes the requirement for natural rock as a building material, which helps to preserve our natural rock resources. Maximum utilization and recycling of by-products and recovered waste materials for economic and environmental reasons have led to the rapid growth of slag utilization. ACC Cement produces a product called eco sand, which is comprised of extremely minute particles and is a by-product of the semi-wet process used in the production of cement (the specific manufacturing technique is not disclosed by the firm for official reasons). It is a finely powdered form of crystalline silica that may take the place of up to fifty percent of the traditional sand that is used in the production of concrete and mortar. Because of its microfilming action, the pores in concrete are reduced, and the material gains improved moisture resistance and, as a result, increased durability.

In the context of this research project, the use of steel slag and eco sand as full replacements for coarse aggregate and fine aggregate, respectively, in the manufacture of concrete is suggested. On the concrete blocks, evaluations of their compressive strength, flexural strength, split tensile strength, and water absorption were carried out. In addition to that, the specimens were put through the durability test. Comparative cost study was performed on M40, which consisted of steel slag and sugar cane bagasse ash..

2. LITERATUREREVIEW

Adriana Pereira and colleagues noticed that the sugarcane bagasse ash (SBA) obtained by auto-combustion had good cementing characteristics as a mineral precursor combined with blast furnace slag (BFS) in alkali-activated systems. These researchers came to this conclusion after seeing that the sugarcane bagasse ash exhibited these qualities. For the preparation of alkali activated mortars, mixtures of blending blast furnace slag (BFS) and sugar cane bagasse ash (SBA) had been used. These mixtures were prepared by using NaOH (8 Molarity solution), sodium silicate (8 Molarity solution in Na+ and SiO2/Na2O molar ratio of 0.5), and an activating solution of KOH (8 Molarity solution). After 90 days of curing, replacements of 25%, 33%, and 50% of BFS by SBA compressive strength were determined in the range of 16–51 Mpa and documented. When compared to BFS, it was seen that the reference mortar specimen, after being cured with ammonia chloride solution for a period of 200 days, showed a decrease of strength of around 83.30%.

Chinnaraju et al. conducted a number of experiments during the course of their inquiry, which ultimately made it possible for steel slag to be successfully used in concrete building operations. By replacing 20% of the sugar cane bagasse ash with it, it demonstrates a stronger strength, and better gains were shown in terms of the durability features of the various mixtures of concrete.

In the course of their examination, Subramani and colleagues noticed that a variety of tests and durations were carried out. In comparison to the standard mix, the conventional mix did not have the same level of strength as concrete that contained sixty percent furnace slag.

In their inquiry, Lamia Bouchhima and colleagues came to the conclusion that numerous tests and durations had been performed. According to the particle distribution curve, the soil that was utilised was a silty-gravel soil, and it was suitable for the stabilisation process. In most cases, a rise in the soil's plasticity Index may be attained with the addition of SCBA and a reduction in the amount of OPC. The compressive strength that was achieved after 28 days for a SCBA:OPC ratio of 1:1.5 was the best possible result, and it generated the maximum strength that was required in the British Standard (BS 5628 Part 1), which was 2.2N/mm2.

In this study, Hariharan and colleagues explored the preparation and characterisation of ceramic items made using waste sugarcane bagasse. A local company produced tiles with compositions consisting of 50% clay, 15% quartz, and 35% feldspar. Sugarcane bagasse ash was utilised in place of feldspar in these tiles. The original formula was modified to use 20% bagasse ash instead of feldspar, which was brought down to 15% of the total.

Kulkarni et al. made the discovery that bagasse ash from sugar cane may be used in place of fly ash in bricks made from fly ash, provided that lime was also included. Bricks with dimensions of 230 millimetres on the long axis, 100 millimetres on the width, and 75 millimetres on the height were produced using a variety of mixtures. Bagasse ash was used to replace fly ash at a ratio of around 60 percent, and lime content was increased to a maximum of 20 percent by weight. Binder content was increased in increments of 10 and 5 percent, respectively. The compressive strength exhibited superior development across the board for all of the curing days, and it also had a lower percentage of water absorption. It was discovered that increasing the percentage of bagasse ash in the stabilised block led to a decrease in the block's overall strength. It was determined that 10% bagasse ash as a substitute for fly ash generated the near strength when compared to the control specimen, with the strength variation practically being less than 5%. This led to the conclusion that the replacement should be used.

According to the findings of Rajkumar and colleagues, the use of sugar cane bagasse ash paver blocks is appropriate for low traffic road pavements. This study focuses on the process of creating and evaluating four different trial mixtures that contain ash from sugar cane bagasse in compliance with BIS and IRC requirements. The design of a flexible pavement suitable for roadways with low traffic volumes comes next after this step. When compared to the control specimens, the compressive strength paver blocks displayed a much closer result. When compared to traditional flexible pavement, the cost of the pavement design that used paver blocks made from bagasse ash was 24.15% lower.

Priyadarshini and colleagues came to the conclusion that the impact of sugar cane bagasse ash might be reduced by using silica fumes as an additive and substituting cement. During the course of the test programmer, two different mix ratios of concrete were studied. Both of these ratios featured bagasse ash, which made up 30% of the binder content, and silica fumes, which served as an additive. Following the casting of hollow blocks for a variety of mixtures, the blocks were allowed to dry in their natural environments before being put through compressive strength and water absorption testing. When compared to the control specimens, it was determined that an appropriate substitution of up to 10% bagasse ash with silica fume admixture demonstrated significantly improved performance. When compared to typical conventional concrete blocks, it was also observed that the cost effective analysis of the various mixtures revealed profits of up to 63.70 percent more than usual.

Researchers from Naibaho and colleagues looked at the possibility of using bagasse ash as a replacement for some of the cement in stabilized bricks. Bagasse ash was added at three different replacement levels, accounting for 5%, 15%, and 25% of the total weight of the binder. In the course of this study, improvements were made to the compressive strength of the brick and its ability to absorb water, with the end goal of producing a stabilized brick that is economical. The inclusion of 25% bagasse ash generated the maximum compressive strength while reducing manufacturing costs by around 32.50% compared to that of ordinary concrete. However, this resulted in an increase in the amount of water that the concrete could absorb.

According to Madurwar et al.'s findings, the use of bagasse ash has the potential to improve the functionality of quarry dust-lime stabilised blocks. X-ray fluorescence tests were used in order to determine the elements and compounds that make up the materials. Bagasse ash was subjected to thermogravimetric testing, which determined that it maintained its consistency up to a temperature of 650 degrees Celsius. The microstructure of bagasse ash was analysed using scanning electron microscopy, and the results indicated that the individual particles included a great number of very small holes. The blocks included lime in an amount equal to 20% of their total weight, with the percentage of bagasse ash ranging from 50% to 80% and the percentage of quarry dust varying from 30% to 0% in increments of 5%.After being cast, the blocks were cured to a dimension of 230 millimeters by 110 millimeters by 80 millimeters. After that, we examined their compressive strength as well as their ability to absorb water and produce efflorescence. In addition, the findings of tests conducted on a traditional brick as well as a fly ash brick were incorporated in the test programmer. According to the findings of the experiment, the combination of 50% bagasse ash, 30% quarry dust, and 20% lime generated the maximum compressive strength of all of the possible combinations. Additional complex physic-mechanical evaluations, such as flexural strength, shear bond, combined compressive, and modified bond strength evaluations, were carried out on this combination as well. Bagasse ash bricks had a greater water absorption rate compared to both ordinary bricks and fly ash bricks. There was no evidence of efflorescence on any of the bagasse ash brick combinations that were examined.

Sugar cane bagasse ash has been chemically and physically characterized, and it has been partially substituted in the ratio of 0%, 5%, 15%, and 25% by weight of cement in concrete, as noted by R. Srinivasan and K. Sathiya. Hardened concrete tests, such as compressive strength, split tensile strength, flexural strength, and modulus of elasticity at the age of seven and 28 days were obtained. Fresh concrete testing, such as the compaction factor test and the slump cone test, were also carried out. The findings indicate that an increase in the proportion of bagasse ash substitution led to a corresponding improvement in the strength of the concrete.

Teixeira et al. discovered that there was a possibility of using quartz in place of the ash from sugar cane bagasse in red earthenware. Tests utilising X-ray fluorescence and X-ray diffraction were utilised in order to characterise the mineral admixture of sugar cane. The texture, flexural strength, and shrinkage of the fired ceramic probes were evaluated for a number of different mix configurations. The addition of bagasse ash as a substitute for quartz resulted in a material with lower flexural strength and an increase in shrinkage with increasing sintering temperature, as determined by the findings of the tests. It was also said that the acceptable amount of sugar cane ash for traditional concrete is up to ten percent of the total volume of the concrete.

According to the findings of K. Ganesan and colleagues, using an ideal quantity of sugar cane bagasse ash that was up to 20% of the cement replacement demonstrated greater strength increase for a variety of mixtures. It has been demonstrated beyond a reasonable doubt that SCBA is a pozzolanic material that possesses the potential to be utilized as a partial cement replacement material and may contribute to the environmental sustainability. This was demonstrated by the fact that it was shown.

The utilization of bagasse ash as pozzolanic materials in concrete was the primary topic of the study that was conducted by NuntachaiChusilp and his colleagues. The replacement amount, which ranged from 10 to 30 percent of the binder's total content, demonstrated an upward trend in compressive strength as the curing days progressed. It was determined that the optimal amount is up to 20% as it results in a 13% improvement in the strength value in comparison to the concrete used as a reference. It was also noted that the highest temperature rises in the range of 13 to 33%; this temperature rise is acceptable in comparison to that of traditional concrete.

3. CONCLUSIONS

The report summarised the characterization and use of bagasse ash, sintered earth blocks, and discarded steel fibres based on literature review:

India produces massive amounts of sugar cane bagasse ash, a solid waste, which might cause disposal issues without proper management. Filters, adsorbents, and soil amendments have been used with this solid waste.

Sugar cane Bagasse ash has two densities: boiler bottom ash and gas washer fly ash. Fly ash has more organic material than bottom ash.

Several investigations found that large concentrations of silica, alumina, and iron oxide improved the pozzolanic process. Ash's pozzolanic reactivity depends on amorphous silica instead of crystalline silica, which depends on calcination temperature. Sieving or milling ash reduces particle size and improves reactivity.

Many researchers have studied mix strength augmentation and water absorption. Bagasse ash is now used in stabilised soil blocks, brick moulds, and paver blocks. Most studies on strength increase, water absorption, and efflorescence of blocks use flexural, toughness, and bond tests.

Thus, sugar cane bagasse waste reduces project costs compared to primary resources. Many studies found that utilising ash with high silica concentration saves money. More durable and suitable for structural concrete.

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