UTILISING BOTTOM ASH FROM WASTE-TO-ENERGY PLANTS FOR SUSTAINABLE CEMENT BLOCK PRODUCTION

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Bottom ash emerges as a by-product from the combustion of municipal solid waste in energy generation plants. The global predicament surrounding the management and disposal of bottom ash, an aftermath of waste-to-energy facilities, remains significant. The use of improper disposal methods has engendered substantial health and environmental predicaments, necessitating pragmatic solutions. This research scrutinises the plausibility of harnessing bottom ash as a substitute for fine aggregate, specifically in the context of cement block fabrication. The study meticulously probes into the mechanical, thermal, and durability characteristics of cement blocks that incorporate bottom ash, all while meticulously adhering to guidelines. Establishing a consistent mixture is pivotal; it entails maintaining a volume ratio of 1:6:3 for cement, fine aggregates, and quarry chips, steadfastly retaining a cement-to-water ratio of 0.8. Central to the investigation is the precise crafting of solid cement blocks measuring 300 mm x 100 mm x 150 mm, accomplished through the conventional table vibratory compaction method. The primary thrust of the study involves methodically incorporating varying percentages of bottom ash into the block matrix, progressing incrementally in steps of 10% across a range spanning from 0% to 60%.

Critical evaluations of the cement blocks' compressive strength and water absorption capabilities were meticulously undertaken at predefined intervals of 7, 28, and 56 days. Conspicuous trends surfaced, unequivocally establishing a direct correlation: higher proportions of bottom ash invariably led to a commensurate reduction in the density, compressive strength, durability, and specific heat capacity of the resultant cement blocks. Counteractively, water absorption capacity exhibited an incremental rise in tandem with augmented proportions of bottom ash. The findings of the research emphatically suggest that within the purview of modest and intermediate-scale cement block production, tailored for load-bearing walls within residential structures not exceeding four stories, the substitution of a substantial fraction of conventional fine aggregate with scrupulously sieved bottom ash from waste-to-energy plants is thoroughly conceivable. The specific mix proportions meticulously examined within the ambit of this investigation convincingly advocate for the replacement of up to 50% of the fine aggregate with bottom ash.

In summative essence, this investigation profoundly underscores the latent potential of repurposing bottom ash a seemingly intricate waste byproduct as a prized resource within the expansive domain of the construction industry. Notably, this approach does not merely address the challenges entailed in inadequately handling bottom ash but also tangibly contributes to sustainable construction practices by effectively mitigating the demand for traditional fine aggregates. While the parameters of this inquiry are judiciously delimited, they form the underpinning for the possibility of wide-ranging future research and innovation, engendering the conscientious utilisation of waste byproducts in forging ecologically attuned construction materials.

Keywords: Bottom ash; Cement block; Strength; Water absorption

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PROBLEM STATEMENT

Our country has faced a **problem in disposal** of solid waste bottom ash

Therefore, there are lots of ash at the ash yard, which leads to a series of environmental problems such as air, water, soil pollution and a huge land area occupied by the ash yard

There may be scarce due to higher utilization of sand, hence bottom ash is a best alternative to replace sand

AIM

To maximize the use of bottom ash from municipal solid waste to energy plants as a partial replacement for river sand in the manufacturing process of cement blocks

OBJECTIVES OF THE RESEARCH

Identify the optimum percentage of bottom ash that can replace sand in manufacturing cement blocks

Evaluate the strength and other properties of the cement blocks to ensure performance with respect to the corresponding standards

ANALYSIS OF RESULTS

After 7, 28, and 56 days, the compressive strength and water absorption of the cement blocks are tested. The findings indicate that increasing the proportion of bottom ash reduces the density, compressive strength, durability, and specific heat capacity of the blocks while increasing water absorption

CONCLUSIONS

- Satisfies the structural requirements up to **50%** of the replacement level
- The produced blocks pose **no health hazards** whether in use or handling
- Cement blocks incorporating 50% BA as a sand substitute exhibit a compressive strength of **6.45 Nmm^{-2}** (exceeding the required value of 5.5 N/mm^2) and a **28-days water absorption value of 181.77 kgm^{-3}** indicating their suitability for construction
- **Cost effective**
- Moreover, these blocks are **light-weight**, with a 12% reduction in density compared to conventional cement blocks
- These blocks can be used for **load-bearing walls in residential buildings up to four stories**