DEVELOPMENT OF A PLASTERING MORTAR USING WASTE BAGASSE AND RICE HUSK ASHES WITH SOUND MECHANICAL AND THERMAL PROPERTIES

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The concept of using cleaner production technologies has become prominent in the present context for achieving sustainability in construction. It has been proven that by incorporating agricultural waste as cement replacement, mechanical and durability properties of the resulting mortar have been enhanced. A comparative study on the mechanical, thermal, and environmental performance of a newly developed lightweight mortar containing agro-wastes namely Bagasse Ash (BA) and Rice Husk Ash (RHA) were investigated. Ordinary Portland cement was partially replaced by BA at dosages of 0%, 5%, 15%, 20%, and 30% and RHA at dosages of 0%, 5%, and 15% by weight. A detailed investigation was carried out to determine the best suited material mix which can achieve very good material properties.

Results indicated that the mixtures with the replacement percentages up to 30% by both BA and RHA for cement had compressive strength confined to the standard recommended range (~5.2 MPa) while maintaining the adequate water absorption and acid alkaline resistance. This indicates that BA can be used to replace the cement up to 30% and BA and RHA of each 15% of cement replacements also can be used to manufacture the mortar for wall plaster and addition of 30% BA as a partial replacement for cement improved the thermal performance by causing a decrease in the thermal conductivity about 33%. However, the combination of BA and RHA (15% each) decreased the thermal conductivity up to 31% compared to the conventional mortar and results indicated that acid resistance also increased with the increase the percentage of BA and RHA,

Further, the assessment of environmental impact reveals a noticeable reduction in embodied GHGE with the increasing replacement of BA and RHA in mortar. When the cement in conventional mortar was substituted with 30% BA and, 15% BA and 15% RHA, both cases reduced the CO2 emissions by about 28% than the control mix. The cost of control for both mortar containing 30% BA and mortar containing 15% BA and 15% RHA production is 16.6% of conventional mortar mix. However, the energy to produce BA mortar is less than BA and RHA mortar. Thus, BA falls more under the prospective of energy effective, cost-effective, and environmentally friendly construction materials.

Keywords: bagasse ash; rice husk ash; sustainable mortar; thermal conductivity; embodied energy

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