DEVELOPMENT OF A NOVEL WASTE BASED INSULATED PLASTER WITH WATER PROOFING ABILITY FOR ROOF SLABS

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The cement industry, notorious for its significant contribution to global greenhouse gas emissions, has drawn increasing attention in recent years due to its environmental impact. As we strive to combat climate change, one crucial area of focus is improving the thermal performance of buildings, which not only reduces energy consumption but also enhances thermal comfort for occupants. Among the various components of a building's thermal envelope, roof slabs stand out as key contributors to heat transfer, accounting for a substantial 50-60% of overall heat exchange. Addressing this thermal challenge necessitates innovative solutions, and one such solution that has gained attention is the use of Rice Husk Ash (RHA) as a sustainable material to augment thermal insulation in roof slabs. This approach aligns with the broader goal of sustainable construction practices and the reduction of greenhouse gas emissions by employing controlled waste disposal techniques that transform waste materials into timely-needed sustainable building materials. The core concept behind this novel approach involves the manipulation of the material's microstructure. To achieve low thermal conductivity, the RHA is employed to induce a pore structure within the material. This pore structure acts as a barrier to heat transfer, significantly enhancing the insulation properties of the roof slabs. Simultaneously, the gaps and voids within the microstructure of the material are filled with non-conductive Waste Brick Powder (WBP). This dual-purpose protection not only improves the thermal performance of the roof but also contributes to enhanced waterproofing abilities. The benefits of this innovative product are impressive, particularly when compared to existing alternatives available in the market. In a comparative analysis, this new material demonstrated a remarkable 69.5% reduction in thermal conductivity, making it an effective solution for minimising heat transfer through roof slabs. Moreover, it exhibited an outstanding 89% improvement in its waterproofing abilities, which is crucial for maintaining the structural integrity of buildings and ensuring the comfort of occupants. This groundbreaking development represents a significant stride towards sustainable construction practices. By harnessing waste materials like RHA and WBP, we not only reduce the environmental footprint of construction but also produce materials that enhance energy efficiency and comfort within buildings. As we continue to address the pressing challenges of climate change, solutions like these offer a glimmer of hope for a more sustainable and environmentally friendly future in the construction industry. In conclusion, the integration of Rice Husk Ash and Waste Brick Powder in roof slab construction is a pioneering approach that holds great promise for reducing greenhouse gas emissions, improving thermal comfort, and advancing sustainable construction practices. This innovation not only contributes to energy-efficient building design but also underscores the importance of repurposing waste materials to create valuable and environmentally responsible building materials.

Keywords: Thermal Comfort; Waste Utilisation; Thermal Insulation; Waterproofing; Green Building Material

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Scope

Add waterproofing properties to waste-based novel insulating mortar developed using RHA by the University of Moratuwa researchers, which possesses only thermal insulation properties.

To improve the waterproofing properties, cement was partially replaced by **Waste Clay Brick Powder(WBP)**

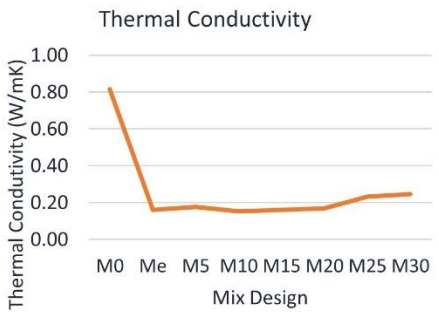
Methodology

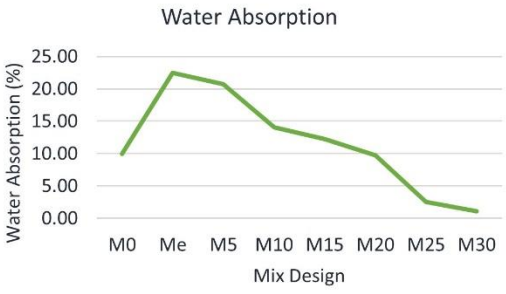
- Carry out background study and identify the problem → Literature Review and Data Collection
- Identifying the parameters existing novel mortar → Identifying a suitable material literature
- Develop the mixtures and laboratory testing for strength, thermal conductivity and water absorption → Compare the results obtained, analyze and arrive at conclusion

Experimental Program

Control Mix	• Cement: sand= 1:3 Water/binder ratio 0.5
Existing Mortar	• Cement: sand= 1:3 but sand replaced by 30% RHA by weight Water/binder ratio 0.5
Mix Design	• **Eight different mortar mixtures**- Varying WBP cement replacement percentages (5%,10%,15%,20%,25%,30% cement by weight)

Results





Conclusion

30% replacement of cement with WBP in RHA-based mortar shows significant improvements.

✓89% reduction in water absorption

✓69.5% reduction in thermal conductivity