SCHOLARLY PUBLICATIONS
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Journal Name: Energy Reports **IF: 5.1**

Title: Enhancing cooling efficiency of pottery clay with rice husk for IoT- enabled off-grid water cooling system

Author: Das, A.; Moulick, S.; Debdas, S.; Vennapusa, V.M.K.; Tripathy, P.K.; Kumar, P.

Details: Vol. 14, December 2025

Abstract: Soil, widely available and known for leveraging the principles of evaporative cooling, has been historically used in pottery-based cooling systems. Enhancing the efficiency of cooling, soil requires improved porosity and water absorption capacity, which can be achieved by incorporating burnout additives like rice husk. Rice husk, an agricultural by-product, is abundant and environmentally problematic when discarded or burned, making its utilization in soil a sustainable solution. This research underscores the potential of rice husk-enhanced pottery soil combined with IoT technology as a transformative solution for eco-friendly and intelligent water-cooling applications. The study investigates to enhance the evaporative cooling efficiency in pottery soil through the integration of rice husk as additives. Soil samples are sourced from three distinct geographical locations in Bhubaneswar, Odisha, and characterized based on their geotechnical and physical properties, including porosity, and water absorption capacity, that directly influence the evaporative cooling. The research aims to determine the optimal soil-rice husk composition for maximizing cooling efficiency. The results indicate that soil from a site is identified with its higher porosity and water absorption capacity, exhibited superior evaporative cooling efficiency. Containers made with 30 % rice husk of the total content demonstrate improved cooling performance due to enhanced porosity and water absorption capacity. The optimized soil composition is further implemented in an IoT-enabled dynamic flow earthen water-cooling system to evaluate continuous cooling performance. Integrated IoT sensors monitor and regulate key parameters such as water temperature, water level of the earthen chambers, and water flow rate, ensuring optimal cooling performance in real-time. The system cool water from 32.5 °C to 20 °C in 4 min and 18 s with a 3 % evaporation rate This system is highly useful in resource-limited areas, as it offers an eco-friendly, passive alternative for water cooling without relying on advanced infrastructures.

URL: https://www.sciencedirect.com/science/article/pii/S2352484725005475?via%3Dihub

SCHOLARLY PUBLICATIONS
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Journal Name: Journal of Sustainable Metallurgy **IF: 3.2**

Title: Sustainable Geopolymer Concrete Paver Blocks for Heavy and Very Heavy Traffic Infrastructure Using Red Mud and Ground Blast Furnace Slag Composite Under Open Air Curing

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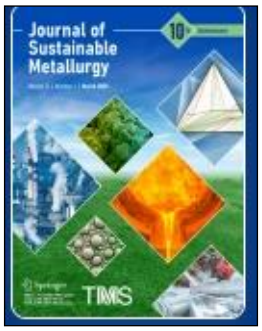
Details: November, 2025

Abstract: This study explores the development of sustainable geopolymer concrete (GPC) paver blocks synthesized with red mud (RM) and ground blast furnace slag (GBS) suitable for heavy and very heavy traffic conditions. The investigation utilized a 10 M sodium hydroxide solution with 50% RM and 50% GBS as source materials, maintaining a sodium silicate to sodium hydroxide ratio of 1.5 and an alkaline solution-to-binder ratio of 0.45. The objective was to prepare paver blocks for both heavy traffic (M50) and very heavy traffic (M55) conditions according to Indian standards. The methodology involved assessment of the mechanical properties of paver blocks, including compressive, flexural and tensile strength. Durability parameters like resistance against abrasion and water absorption were checked. The microstructural development of GPC paver blocks was examined through scanning electron microscopy and energy dispersive X-ray analyses. The sustainability of the paver blocks, checked through cost–benefit analysis, embodied carbon and embodied energy. Results demonstrated exceptional performance of GPC paver blocks with 28-day compressive, flexural and tensile strength 29, 25 and 67% more than the requirements meant for heavy traffic conditions (M55). The resistance against abrasion and water absorption of RM-GBS GPC paver blocks was 21 and 50% less than the requirements. The cost, carbon and energy performance of RM-GBS GPC paver blocks were 6, 40 and 44% better than normal concrete paver blocks. The findings highlight the viability of RM-GBS-based GPC as a sustainable alternative to conventional concrete for heavy-duty paver block applications, offering superior performance characteristics.



URL: https://link.springer.com/article/10.1007/s40831-025-01331-9