

# Enhancing concrete sustainability using crushed peanut shells: An analysis of thermophysical properties, durability, and application potential in construction

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## Abstract:

This study explored the integration of crushed peanut shells (PS) into concrete with an emphasis on sustainable construction. Uniquely, it examines the impact of PS morphologies at low incorporation rates (0–6%) on the thermophysical properties and durability of concrete through rigorous experimental analysis and computational simulations. Our findings reveal that PS significantly enhances insulation properties and reduces thermal metrics and density while maintaining structural viability despite a slight increase in water absorption and a reduction in compressive strength with higher PS content. This investigation not only highlights the potential of PS-concrete to improve the thermal efficiency of building envelopes but also introduces it as an innovative approach to using agricultural by-products in eco-friendly construction. The results indicate significant advancement in the development of sustainable building materials, contributing to enhanced construction practices with environmental benefits.

## Keywords:

Compressive strength; Energy-efficient concrete; Peanut shells; Thermal simulation; Thermophysical properties; Time lag