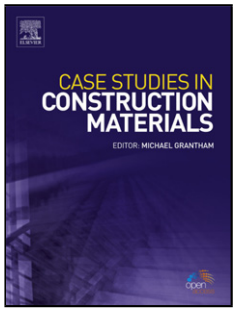

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Utilization of rice husks in a water-permeable material for passive evaporative cooling

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Abstract

This research aims to use the byproducts of rice processing: the rice husk, coarse rice bran and rice polish, to experimentally develop a water-permeable material for evaporative cooling. The starting materials consisted of laterite, fine sand, Portland cement, rice byproducts and water. Mixtures with different material proportions were molded into interlocking blocked and cylindrical shapes, dried and cured in air indoors. In interlocking blocks connected into a column, the proportion of laterite, fine sand, Portland cement and coarse rice bran with a ratio of 4:2:1:3 absorbed the most water and yielded a maximum water height of 42 cm. In the cylindrical porous material, the maximum water height of 54 cm was found in the mixture with volumetric proportions of 3:2:1:4. The pore sizes of the porous cylinder were in the range of 0.03-3 μm. The investigation of the thermal performance of the developed material was conducted in an experimental chamber with an air temperature of 32-37 °C and relative humidity of 54-76% flowing through four rows of water soaking porous cylinders. The distance between two rows of water soaking porous cylinders was also varied from 11.2 cm to 14.0 cm and 16.8 cm. The air temperature was found to be reduced by 0.5-2.7 °C. The highest temperature reduction was found in the porous cylinders that had a distance between the rows of 16.8 cm and operated under high air temperature. The water consumption of 31.6 mL/hour was lowest for the porous cylinder with a distance between two rows 16.8 cm apart. The developed product was appropriate for evaporative cooling in agricultural houses and outdoor spaces.