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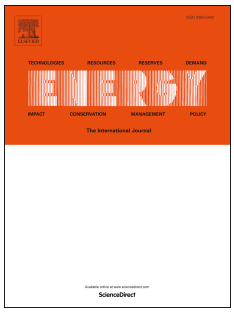

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Thermal comfort model analysis and optimization performance evaluation of a multifunctional ice storage air conditioning system in a confined mine refuge chamber

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ABSTRACT

A multifunctional ice storage air conditioning system was designed and its working principle, working mode and structure modification were improved. It can achieve cooling, dehumidification when the energy supply is either exhausted or adequate. The PMV grade method has been modified and applied, and thermal comfort model is obtained and the acceptable upper limit of human body temperature and humidity tolerance range is 35℃ and 80% RH. Thermal load and humidity load model were defined, analyzed, and verified by human survival experiments. Finally the optimization performance of this ice storage air conditioning system was validated through theoretical calculation and experimental verification and technical parameters appropriate for engineering applications were analyzed. The temperature and humidity in refuge chamber are eventually controlled at 31℃and 77% RH. According to the experiment subjects, the living environment in refuge chamber is quite comfortable and thermal sensation is not stuffy. It can be concluded that the energy consumption of air conditioning fan reduced by 35%, the ice storage needed reduced by 15%, the rated air velocity of air conditioning was analyzed and the effective working time of this system was determined to be not below 96 h for 8 persons to survive in a refuge chamber.

KEY WORDS: Thermal comfort model; Ice storage air conditioning; Thermal load; Humidity load;

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