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Optimization and performance experiments of a $\text{MnCl}_2/\text{CaCl}_2\text{-NH}_3$ two-stage solid sorption freezing system for a refrigerated truck

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Highlights

- Off-the-shelf heat exchangers are chosen as the evaporator and the condenser.
- An expansion valve is utilized in the sorption freezing system.
- The optimized system can satisfy requirement even for transporting frozen goods.
- The total mass of the system is reduced to approximately 150 kg.
- The refrigerating capacity is 2.06 kW at the refrigerating temperature of -10°C .

Abstract: Based on the earlier-established $\text{MnCl}_2/\text{CaCl}_2\text{-NH}_3$ two-stage solid sorption freezing system for a refrigerated truck, a series of optimization designs are conducted in this prototype system. For sorption beds consisting of many unit tubes, the arrangement mode is changed to the staggered arrangement. Off-the-shelf heat exchangers from refrigeration industries are chosen as the evaporator and the condenser, and an expansion valve is also used. The total mass of the optimized system is reduced to approximately 150 kg. Firstly, different refrigerating temperatures ranging from -25°C to 0°C are investigated, and experimental results show the optimized system can easily satisfy requirement even for transporting frozen goods. The earlier-established system can only satisfy requirement for transporting fresh goods. Simultaneously, the cycle time can be reduced to 45 min. Through the optimization, both the refrigerating capacity and the total mass of the system can satisfy requirement of

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