

Abstract

An automated ice production system which operates in a continuous manner has been designed for use in commercial settings to handle successive chilling of beverages. This R134A based vapor-compression system uses two evaporator plates, in contact with a reservoir, to freeze liquids into solids. The performance has been characterized both theoretically and experimentally on a test reservoir, but information on energy consumption and efficiency had only been partially incorporated. Experiments were set up in similar fashion to those in previous studies, with matching parameters of operating/evaporating pressures for the refrigerant (30kPa, 80kPa, 105kPa, 120kPa) and cycle times (5 min, 10 min, 20 min, 30 min). Tests were run in isobaric fashion except for spikes during hot gas injection phases and plate switches. Ice growth was recorded when the system reached steady-mass operation and data was manipulated to find COP values ranging from 0.6 to 0.909. The most effective combination of parameters was a 10 minute cycle and 80kPa. Two tests with high COP values were further tested. One test involved looking at ice growth and energy use during transient phases, when the ice-water reservoir's temperature ranged from 1°C to 7°C. COP values there could be insightful for cases of active heat load from Cooper Cooling Process equipment exceeding thermal storage cooling load. The other test involved looking at COP values for steady-mass operation of a system with passive load being used to cool an adjacent space. Although there was less passive load on the system for this case, ice growth was diminished in comparison to the first set of tests. System efficiency reached up to 15% of the maximum operational efficiency. Improvements could be made in equipment design and hot gas injection necessity. These numbers may not directly correlate to the new equipment.