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Shell side direct expansion evaporation of ammonia on a plain tube bundle with inlet quality effect in the presence of exit superheat

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Highlights:

- Direct expansion of ammonia on shell side of a shell and tube evaporator.
- Reduced charge compared to conventional flooded or spray evaporator.
- Inlet quality effect in the presence of exit superheat
- Correlation developed with inlet quality effect in the presence of superheat.

Abstract

In the present study, tests were performed to investigate the direct expansion evaporation characteristics of ammonia on shell side of triangular pitch plain tube bundle at saturation temperature of -1.7 °C and -20°C, with heat flux ranging from 5 to 45 kW m⁻², and inlet quality from 0 to 30% with exit degree of superheat ranging from 2 to 10°C. The results suggest that heat transfer coefficient increases with both saturation temperature and heat flux and decreases with degree of exit superheat. The inlet quality effects were more significant at higher saturation temperature than at lower saturation temperature. A correlation was developed for outside boiling of ammonia on plain tube bundle in direct expansion mode with inlet vapor quality and compared with previous pool boiling and bundle correlations with ammonia as a refrigerant.

Keywords: Boiling, ammonia, refrigeration, inlet quality, direct expansion, superheat, shell and tube

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