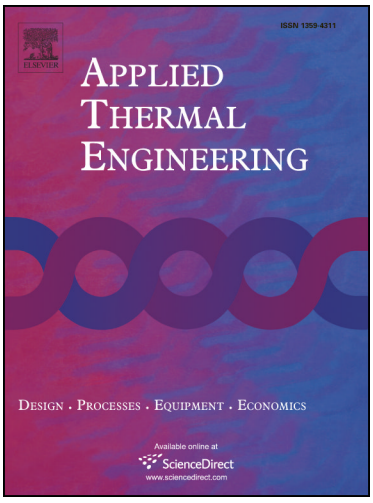

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Temperature Distribution Measurements and Modelling of a Liquid-Liquid-Vapour Spray Column Direct Contact Heat Exchanger

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Research Highlights

- Measurements and calculation of T_c and T_d along 3-phase spray column DCHE.
- Effect of Q_c, Q_d, D_{nz}, ja and sparger configuration was examined.
- T_c decreases with Z, whilt T_d increases
- $T_{c\ out}$ increases with increasing continuous phase flow rates.
- $T_{c\ out}$ decreases with increasing dispersed phase flow rates.
- $T_{c\ out}$ increases with increasing Ja.

Abstract

This study investigates the temperature distribution of a liquid-liquid-vapour three-phase direct contact heat exchanger, both experimentally and theoretically. The experimental investigation was conducted using a Perspex column with an internal diameter of 10 cm and 100 cm height. Liquid pentane at its saturation temperature and warm water were used in the dispersed phase and continuous phase respectively. Various dispersed phase flow rates $(10, 15\ \&\ 20\ L/h)$ and continuous phase flow rates $(10, 20, 30\ \&\ 40\ L/h)$ were tested using three different sparger configurations $(7, 19\ \&\ 36$ nozzles) and two different nozzle diameters (1 & 1.25 mm). The results showed that the temperature of the continuous phase decreased with the height of the heat exchanger from its inlet at the top towards its outlet at the bottom. This behaviour was entirely opposite to the dispersed phase that flows counter currently with the continuous phase in the heat exchanger. For the same sparger and constant continuous phase flow rate (Q_c), the outlet temperature of the continuous phase was inversely affected by the dispersed phase flow rate (Q_d); while decreasing the nozzle numbers in the sparger led to a decrease in the outlet temperature of the continuous phase. Furthermore, the