Impact of Liquid/Vapor Maldistribution on the Performance of a Plate Heat Exchanger Evaporator for Pure and Mixed Refrigerants - DTU Orbit (02/08/2019)

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This paper presents an estimation of the degradation in heat transfer performance in plate heat exchanger (PHE) evaporators due to flow maldistribution. A booster heat pump system integrated in a district heating network is used as a case study. Butane and two zeotropic mixtures, namely Propylene/Butane (0.5/0.5) and R1234yf/R1233zdE (0.5/0.5) were evaluated as working fluids. A two-dimensional (2D) numerical model was developed for the evaluation of the total heat flow rate degradation due to the imposed uneven liquid/vapor distribution at the inlet of the PHE channels. Butane showed the largest sensitivity to both the effect of end plates and maldistribution, with an overall reduction of the heat flow rate equal to - 11.2 %. Both the zeotropic mixtures were only insignificantly affected by the uneven quality distribution at the inlet, and suffered a slight reduction of the overall heat flow rate of - 0.9 % and - 0.8 % respectively, due to effect of end plates. Last, the sensitivity to the boundary conditions of the case study was assessed for the mixture Propylene/Butane (0.5/0.5), evaluating the dependence of the obtained results from superheat and number of channels, since both parameters impact the degradation of heat transfer performance.

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