

## Derivation of guidelines for the design of plate evaporators in heat pumps using zeotropic mixtures - DTU Orbit (09/11/2017)

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The present work derives design recommendations for plate heat exchangers used for evaporation of zeotropic mixtures in heat pumps. A parametric study is conducted on the geometry of the heat exchanger, and the analysis is carried out for four working fluids, based on a case study of heat pump integration in a spray drying facility. A numerical model of the evaporator is combined with cycle calculations, for estimating the impact of heat transfer area and pressure drop on the coefficient of performance and costs. Common trends are obtained as optimal configurations for the four considered fluids. It is recommended to minimize the hydraulic diameter by employing high corrugation height over low corrugation pitch. Moreover, an optimal range is found for the liquid Reynolds number at the evaporator inlet. The suggested values vary between 500 and 2000, depending on the fluid. Lastly, the trade-off between minimization of area and pressure drop is found by assessing the relative impact on costs of the heat exchanger area and pressure losses of both working fluid and heat source. The result shows that it is not always convenient to minimize the heat transfer area, since the mixture pressure drop negatively influences compressor investment and operating costs.

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