Supplementary Material

Figure 1 shows the composite curve for the CSF-CAP with the optimized operating conditions. Linear temperature profiles have been assumed, essentially lumping sensible and latent heat effects into a constant slope. The position of the cold streams (in blue) on the enthalpy axis is determined through the minimum ΔT condition (i.e. 3 K) between the dissolving stream and the crystallizing stream. The target temperature of the regeneration stream is given by the specification of reaching a vapor fraction of 1–3 %-mol as discussed in Section 4.2.2. The high temperature of the regenerated lean stream is utilized to heat the regeneration stream in the RL-HEX, hence these two streams have to be on top of each other.

The conceptual flowscheme in Figure 2 utilizes the lean stream coming from the cold end of the RL-HEX to warm the regeneration stream in the first counter-current dissolution heat exchanger (CCD1). Then, in CCD2, waste heat at 50 °C is used to achieve complete dissolution. The amount of waste heat is determined by the ΔH between the hot stream of CCD1 and the hot stream of the RL-HEX (see Figure 2). In this example, 27 % of the chilling energy demand in the crystallization are covered by the regeneration stream undergoing dissolution in SSC1 and by the warming of the recycle stream in SSC2.

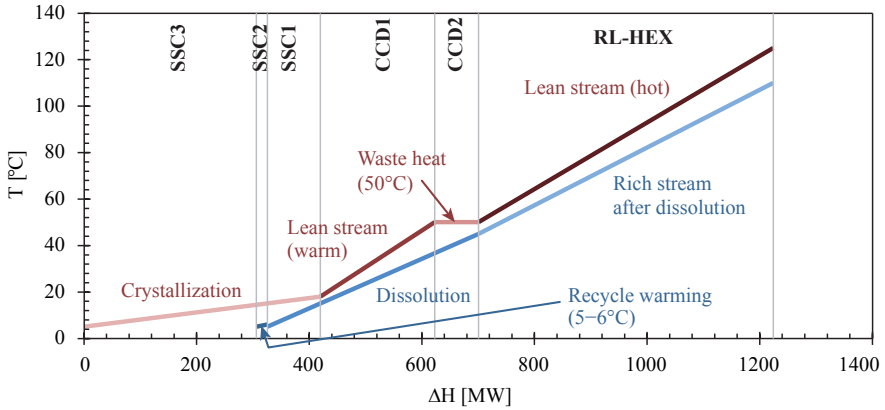

Fig. 1 Composite curve for the CSF-CAP assuming the optimized operating conditions. See Figure 2 for a detailed flowscheme that enables such heat integration.

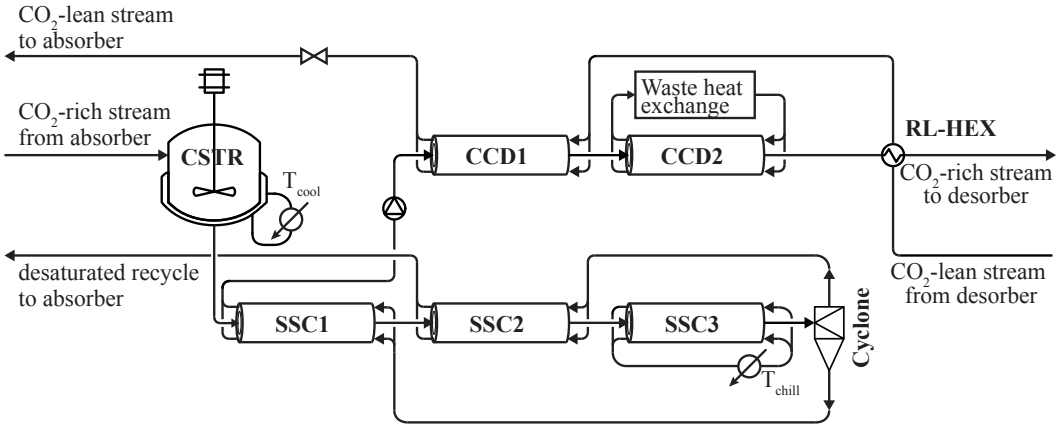

Fig. 2 onceptual flowscheme illustrating all the heat integration equipment considered in the pinch analysis in Figure 1. The scraped-surface crystallizers (SSC) and the counter-current dissolvers (CCD) enable counter-current heat transfer between suspensions. They can in principle also be realized as a cascade of continuously stirred tank reactors (CSTR).

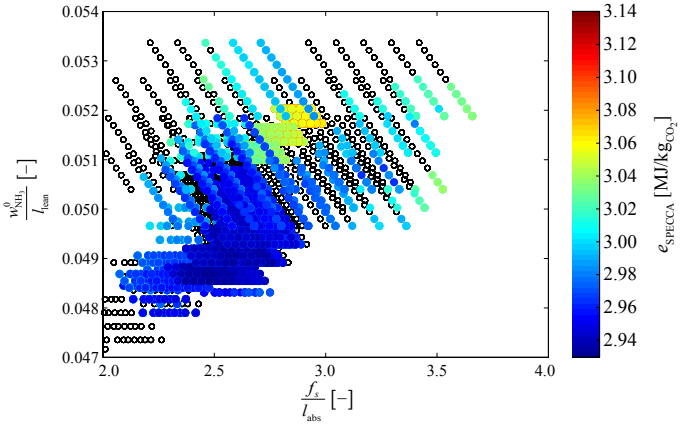

Fig. 3 Variable range covered by the L-CAP simulations. Each point corresponds to one simulation. Black circles represent simulations that did not reach convergence or did not meet the specifications. The coordinates are a combination of the varied input parameters.

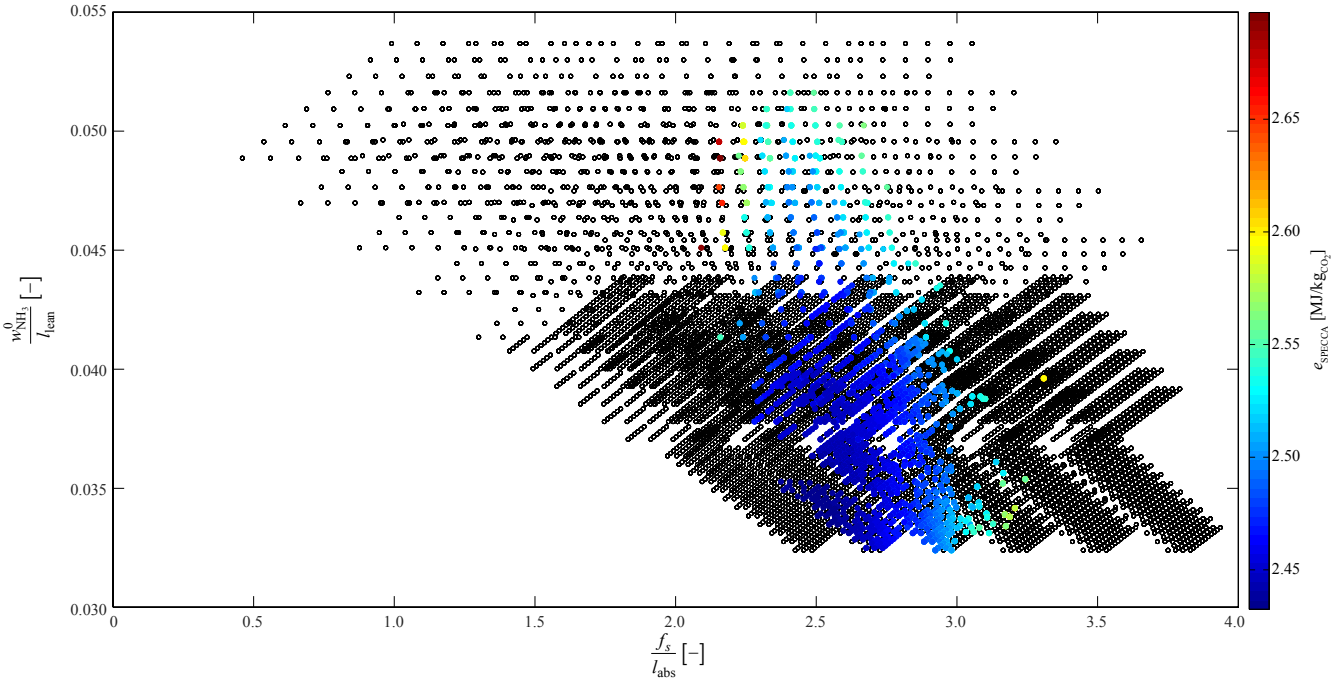

Fig. 4 Variable range covered by the CSF-CAP simulations. Each point corresponds to one simulation. Black circles represent simulations that did not reach convergence or did not meet the specifications. The coordinates are a combination of the varied input parameters.