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Optimal design of dual-reflux pressure swing adsorption units via equilibrium theory: process configurations employing heavy gas for pressure swing

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HIGHLIGHTS

- An optimal design strategy is presented for the process configuration DR-PL-A.
- Key parameters needed to establish complete separation at CSS are identified.
- An operating window for achieving complete separation at CSS is proposed.
- The influence of process variables (adsorbent selectivity, feed gas composition and, operating pressure ratio) on the design parameters and a novel criterion (that facilitates the choice amongst DR-PL-A and DR-PH-A process cycle configuration) is discussed.

ABSTRACT

Dual-reflux pressure swing adsorption process is theoretically capable of completely separating binary feed gas mixtures into two pure species. The pressure of bed to which the binary gas mixture is fed and the type of gas utilized for pressure swing, results in different process cycle configurations, even if the majority of the previous studies of DR-PSA are restricted to two cycle configurations: that employ heavy gas for pressure swing and deliver feed to the bed operated at either high or low pressure. However, the comparative assessment and the optimal operating pressure ratio of these two process cycle configurations are not well-established. We previously reported an optimal design strategy (that identified a triangular operating zone, inside which, complete separation of binary gas mixtures can be achieved) for one such DR-PSA process cycle configuration. In this work, we report an optimal design strategy for

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