515b Psa Cycle Selection for Binary Gas Separations – Dual Reflux, Rectifying or Stripping Cycles?

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The optimization of pressure swing adsorption processes (selection of operating variables to yield optimal performance) is a time-consuming process but the technique is well developed and has been the subject of much investigation in the past. All of these past studies have usually assumed the form of the cycle (sequence of process steps) before optimization commences. Thus it is implicitly assumed that the "optimal" cycle has already been specified. This is seldom true as evidence by the large number of process cycle patents. In this study, we consider the difficult matter of cycle selection for a binary separation (A and B in which A is strongly adsorbed). Analysis is done using the method of characteristics. Cycles are classified and some new cycle options are discussed. The choice of which cycles to use to accomplish a specified separation depends on feed mole fraction of the strongly adsorbed component, quality of the adsorbent, desired product (A or B) and the relative importance of capital vs operating cost. We show that under the constraints imposed, some cycles are more "robust" than others ("work" under all conditions) and some counter-intuitive results are presented. Some overall heuristics are presented help decide on the merits of one cycle over another before traditional optimization commences.