Economic analysis of a horizontal diabatic separation system

Model-based methods and tools are applied to preliminary analysis of a mobile heat integrated horizontal separation system. An economic model, based on Guthrie’s modular approach, is developed for analysis of capital and operational expenditures. The separation system consists of two, co-axially arranged tubes. The inner one is serving as a stripping section and the outer one as rectifying section. First, a steady state model is developed using n non-equilibrium stages based on mass transfer modeling. Sensitivity analysis has been performed to assess the impact on system performance, of variations of transport coefficients and design variables. The model together with an economic model has been applied to identify design and operational limitations on such a unit. The analysis investigates the total annual cost dependence of heat transfer area, alcohol concentration in the feed and rejected amount of water in the stripping section for different locations of interest. It has been found that the overall operating costs are significantly reduced for higher alcohol concentration in the feed and high discharge of water at the end of the stripping section. On the other hand, increased heat transfer area between the stripping and rectifying section leads to higher capital costs and is not necessarily balanced by lower operating costs.