

Abstract:

Heat and mass such as water and solvents are two key utilities in process industry. Simultaneous reduction of both utilities can reduce plant capital as well as operating costs. Though there are mathematical modeling techniques that can produce global optimal solutions, graphical methods are often preferred to provide insights through visualization. This paper presents a new graphical approach named superimposed mass and energy curves (SMEC) for simultaneous mass and heat reduction applicable to both mass transfer-based and non-mass transfer-based systems. Source and demand allocation curves and heat surplus diagram are superimposed on a plot of flowrate versus mass load/temperature to guide design towards the minimum utility targets. This method provides a useful visualization tool on the simultaneous effects of mass and energy reduction. Application of the graphical procedure on case studies involving water and ammonia solvents achieved the minimum mass consumption and near optimal energy usage.