

过程系统工程

采用浓度差同步优化的质量交换网络设计

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摘要

质量交换网络(MEN)综合作为过程集成的一个分支,越来越受到过程系统工程领域的广泛关注。因为质量交换网络综合时,贫、富流通股之间对应的浓度差(ϵ)反映传质推动力,影响操作费用和投资费用的大小,所以对其进行优化意义重大。而现有的质量交换网络综合设计一般将贫、富流通股之间对应的最小允许浓度差假设为固定值,不能保证得到最优的质量交换网络。针对这一问题,介绍了一种同步优化方法,既能处理单杂质体系,又能处理多杂质体系,建立质量交换网络的超结构模型,以年度总费用(TAC)最小为目标,将每一对贫、富流通股对应的浓度差作为变量,权衡操作费用和投资费用,并利用改进的遗传算法求解,同步得到年度总费用的最小值以及对应的一组最优浓度差,从而得到最优的质量交换网络。

关键词 [质量交换网络](#) [浓度差](#) [同步优化](#) [多级超结构](#)

分类号

Mass exchange network design using simultaneous optimization of composition differences

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Abstract

As one of the branches of process integration, the synthesis of mass exchange network (MEN) has attracted more and more attention in the area of process systems engineering. When synthesizing a MEN, the composition differences (ϵ) reflect the impetus of mass transfer between rich and lean streams and affect the operating cost and capital cost significantly, so they should be optimized in order to obtain a real optimal MEN. However, so far they are usually given arbitrary values in most literatures, which cannot guarantee an optimum MEN obviously. This paper presents a simultaneous method to solve the problem of ϵ in a single-contaminant or multi-contaminants system, which builds the superstructure model of the MEN first, takes total annualized cost (TAC) as an objective and considers ϵ as a set of variables to balance operating cost and capital cost. Then the mathematical model is solved by means of an improved genetic algorithm. Finally, the minimum TAC and corresponding ϵ values, as well as an optimal MEN are also obtained simultaneously.

Key words

[mass exchange network](#) [composition difference](#) [simultaneous optimization](#) [multilevel superstructure](#)

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