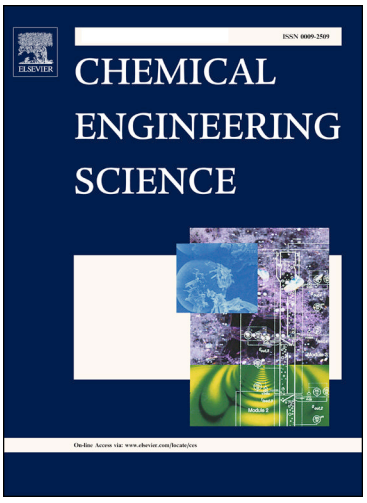

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Optimal design of hybrid cryogenic flash and membrane system

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Abstract

Combining cryogenic flash units with membrane units is attractive for gas separation processes such as effluent gas recovery and CO_2 capture. However, systematic design methodology for such hybrid systems have not been reported yet. The hybrid system is a complicated system that not only includes separation units, but also includes pressure manipulation units and heat exchangers. A two-step decomposition strategy is proposed to deal with the design of such complicated system. The separation sequence is first determined with energy consumption consideration in the first step. Subsequently, the remaining energy recovery units, the heat exchanger network and turbines are simultaneously synthesized with the separation flowsheet optimization. When applying the proposed strategy to recover the effluent gas from polyolefin plant, we find a novel flowsheet that avoid intensive capital and operating cost by tightly integration of process units.

Keywords: process design, heat exchanger networks, cryogenic, membrane.

1. Introduction

Cryogenic and membrane separation are common tools for gas separation (Tu et al., 2016). Since the performance of cryogenic and membrane separation are subject to thermodynamic