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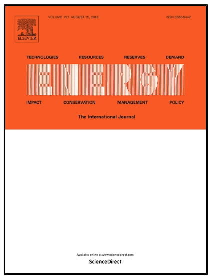

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Ejector integration for the cost effective design of the Selexol™ process

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Abstract

This work introduces a novel approach to reduce the energy demand as well as capital and operating costs in a widely used gas purification process by optimal integration of ejector technology. Three scenarios for ejector integration have been identified into a dual-stage Selexol™ process configuration for H_2S and CO_2 removal from syngas. The clean syngas met the requirement to be used in an integrated gasification combined cycle. The intention was to unload or eliminate compressors used in the conventional design, and to reduce the capital and operating costs. Aspen HYSYS® is used to develop a detailed simulation model of the Selexol™ process and to assess the impacts of the proposed design configurations from an energy and economic perspective. A predictive design model is also used to evaluate the operating conditions of the proposed ejectors. Among the scenarios investigated, it is found that ejector integration is attractive only if one or some compressors can be eliminated. This work shows that an optimally integrated ejector in the CO_2 recovery and compression section of the Selexol™ process can reduce the capital costs by up to 28%, while reducing the operating costs by up to 6%.

Keywords: Syngas purification, Process simulation, Selexol™, Ejector technology, Heat integration

1. Introduction

Industrial facilities such as oil refineries, petrochemical plants, and non-ferrous metal smelters generate large quantities of gases that need to be cleaned prior to being processed into valuable products, flared, or rejected in the atmosphere [1]. This is also the case for syngas from gasification processes, which is receiving growing interest as an important pathway to produce chemicals, fuels or power [2]. The presence and quantity of acid gases such as hydrogen sulfide (H_2S), carbonyl sulfide (COS), and carbon dioxide (CO_2) depend on the feedstock used and the processes involved [3]. Due to increasingly stringent environmental regulations on air emissions and to prevent the harmful impact of acid gases on downstream equipment and processes, these gases must be treated to reduce their concentration to acceptable levels.

Gas cleaning technologies that have been used in process industries for decades often suffer from high investment costs and intensive energy requirements. New developments in this area have been tremendously accelerated in recent years as the Intergovernmental Panel on Climate Change (IPCC) has urged the establishment of a global policy to significantly reduce greenhouse gas (GHG) emissions through stricter environmental regulations [4]. The majority of the developed technologies are more