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Advanced Exergy Analysis of Heat Exchanger Network in a Complex Natural Gas Refinery

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Abstract

In this paper, the advanced exergy analysis was used to determine the avoidable and unavoidable exergy destructions of the heat exchanger networks (HENs) in a complex natural gas refinery in the South Pars gas field, focusing only on the improvement of the avoidable part. Exergy balances were evaluated for the HENs and the equations of advanced exergy destruction and exergetic efficiency for the HENs were developed. The total exergetic efficiency of the HEN in the plant was determined to be 62.8% that could be increased up to 84.2%, suggesting a high potential for improvement. Also, it was shown that the HEN1 had the most severe condition in the plant with the highest inefficiencies among the other networks. The avoidable and inevitable irreversibilities were calculated for all the heat exchangers running in the plant network. The advanced exergy analysis revealed that the exergy destruction had two major contributors. First, about 59% of the total irreversibility of the system was avoidable and could be eliminated by the well-known optimization techniques. Secondly, only 18 most inefficient heat exchangers (17% in numbers) contributed to more than 61% of the total exergy destruction in the plant network. Hence, there was a high potential for improvement of the operational cost in such a huge consuming energy system.

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