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Bahram Ghorbani, Mehdi Mehrpooya, Reza Shirmohammadi, Mohammad-Hossein Hamed



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A Comprehensive Approach toward Utilizing Mixed Refrigerant and Absorption Refrigeration systems in an Integrated Cryogenic Refrigeration Process

Bahram Ghorbani¹, Mehdi Mehrpooya^{*2}, Reza Shirmohammadi², Mohammad-Hossein Hamed³

¹Faculty of Engineering Modern Technologies, Amol University of Special Modern Technologies, Amol, Postal Code: 46168-49767, Iran

²Department of Renewable Energies and Environment, Faculty of New Sciences & Technologies, University of Tehran, Tehran, Iran

³Mechanical Engineering Faculty, Energy Conversion Group, KNToosi University of Technology, Tehran, Iran

This study progresses absorption, mixed refrigerant and mixed fluid cascade refrigeration systems in the integrated cryogenic natural gas plant. It also presents a comprehensive systematic method for designing of refrigeration cycles based on synthesis of mathematic and thermodynamic viewpoints. The possibility of using absorption refrigeration system in lieu of precooling stage of mixed fluid cascade refrigeration cycle with the aim of reducing in energy consumption is investigated. In this way, the high amount of energy consumption in these units because of eliminating of some parts of mixed fluid cascade system has been reduced, and the possibility of using wasted energy of plant has been provided. Then, energy, exergy and economic analyses are carried out using simulated data. Economic analysis is carried out using annualized cost of system for the two structures. Using absorption refrigeration systems as an alternative to compression refrigeration system in the integrated structure causes reduction in the amount of specific power, capital cost, and prime cost of product by 38.94%, 31.9%, and 15.31%, respectively. Sensitivity analysis of economic parameters with respect to utilities price as well as products price on the market has been done.

Keywords: *Nitrogen removal unit, Economic optimization, Thermal integration, Mixed fluid cascade (MFC), Absorption refrigeration, Non-Linear Programming.*

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