

Synthetic Natural Gas Derived Hydrogen Separation and Purification: Comparative Evaluation of Membrane-and-Cryogenic-assisted Approaches

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Currently, hydrogen is mainly produced from fossil fuels along with other components such as CO, N₂, and CO₂. Hydrogen (H₂) is separated and purified before its use as a fuel. H₂ separation and purification is a challenging issue mainly due to stringent product specifications. Conventionally, the pressure swing adsorption method is adopted to produce high purity H₂. In this study, the non-conventional approach i.e., membrane and cryogenic is adopted to separate H₂ from SNG and analyze from energy, exergy, and economic perspective. The membrane-based H₂ purification method achieved 98.85% H₂ purity while the cryogenic-based method achieved 99.999% H₂ purity. However, the cryogenic approach is more energy-intensive (SEC: 11.11 kWh/kg) than the membrane process (SEC: 4.38 kWh/kg). These approaches can be explored further to achieve high purity H₂ at low SEC.