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Membrane modelling for nitrogen removal from natural gas

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Membrane technology is an effective and new method to separate nitrogen from natural gas and the possibilities are investigated considering the operating parameters and economics of the process using process simulator Aspen PLUS. The study also analyses the possibilities of using Aspen PLUS as potential software for design and membrane modelling. Process simulation and mathematical modelling studies of membrane separation process for nitrogen capture is very limited, commercially available process simulation softwares doesn't have a membrane model for designing the process. A well developed and validated two dimensional and binary cross flow model from literature is used in this work which is incorporated with Aspen PLUS as a user defined model using MS excel programming for designing and optimizing the system. In previous works, we characterized the concentration dependence of the diffusion coefficient of the adsorbate and adsorbed species, which resulted in affecting the permeability and selectivity of the membrane. These results are also incorporated to the model to evaluate accurate and precise separation efficiency. This modelling can be used to investigate the effect of process conditions like temperature, pressure, composition and membrane characteristics in the efficiency of nitrogen-methane separation and the retentat and permeate properties. Membrane properties and operating conditions have influence in the economics of the process and optimization is essential. The results shows membrane technology is a promising alternative for nitrogen separation, and significant methane recovery is possible that minimizes the challenges in natural gas processing.

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