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Numerical analysis on purification of methane through the hollow fiber membrane system

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The polysulfone membrane was found to be applicable to the selective removal of CO_2 from a biogas, resulting in preparation of the relatively concentrated methane. The purified methane might be utilized as a vehicle fuel if the methane concentration is kept higher than the 95 mole %. Generally speaking, the concentration of methane in the biogas is around 20 mole %, which should be upgraded using a cascade operating system. Even if there are several conventional technologies, the membrane system is known to be not only a new technology, but also an economical method. The cascade membrane system may be constituted of either two membrane modules or three membrane modules, depending on the input biogas conditions and the degree of purification of methane. In this study, a theoretical analysis on the cascade membrane system is proposed and a proper numerical technique is applied to solve the obtained differential equations where the permeate flow rate and the concentration of the each component will be described in terms of the permeability and the partial pressure difference across the membrane. As the operating conditions are changed, the obtained flow rate and the concentration of methane as a product are found to be severely affected. As a design tool, this numerical analysis is strongly recommended since the proper operating condition will be suggested together with the suitable recycle flow rate for the target goal such as the recovery ratio and the purity of methane in the final product. The cascade schemes and the analysis results will be presented.

Biography

Yongtaek Lee has completed his PhD from the State University of New York at Buffalo. He is currently the Head of the Department of Chemical Engineering, Chungnam National University. He has published more than 100 papers in reputed journals.

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