

عنوان مقاله:

Mathematical Modeling Methods and Their Application in the System Analysis for Methanol Steam Reforming Process

محل انتشار:

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خلاصه مقاله:

Hydrogen is the key to achieving sustainable and clean energy in the world's future, and research in the field of optimal hydrogen production has been growing in the past years. This research discusses the mathematical modeling of the Methanol Steam Reforming Process in membrane reactors to produce hydrogen. Modeling is developed with the principles of energy, mass, and momentum conservation; In cases where the temperature is constant, only the conservation of mass will be used, and both energy and mass equations will be used in non-isothermal cases. This modeling is finally upgraded from one-dimensional to two-dimensional in the length and radial of the reactor. In each mathematical model, molecular and thermal diffusion relations are used as auxiliary equations to complete the modeling. In the final step, the effect of different variables such as temperature, pressure, and the reactor and membrane's physical conditions is analyzed to determine the optimal operating conditions for the developed mathematical models. The predictability of chemical processes behavior like the methanol steam reforming process can be achieved through basic mathematical modeling concepts. The results from the conceptual examination of the mathematical model are compared with various simulation results carried out in other articles, revealing their consistency. Basic mathematical models are superior to complex simulations as they can be leveraged to develop intelligent expert systems or predictive maintenance programs that deliver desired outcomes rapidly and cost-effectively.

کلمات کلیدی:

Methanol steam reforming, mathematical modeling, Hydrogen production, Membrane reactors, Conservation of mass and energy, System analysis

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