Production of Synthesis Gas with $H_2/CO=1.0$ for Fischer-Tropsch Process: Modeling and Comparative Analysis

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Synthesis gas, which is a mixture of hydrogen and carbon oxides, is a versatile intermediate product for the production of valuable chemical products, e.g., methanol, ammonia, dimethyl ether, and synthetic liquid fuel. Given a number of technologies available for the production of synthesis gas, such as methane reforming, gasification, partial oxidation, and CO_2-H_2O co-electrolysis, they greatly differ in their energetic, economic, and environmental performances. In order to evaluate and compare their performances in a comprehensive manner, we develop process models of synthesis gas production processes using a commercial process simulator Aspen Plus®. The target synthesis gas represents the H_2/CO ratio of 1.0, which is suitable for the Fischer-Tropsch process with Fe-based catalysts in the downstream. We analyze the energy efficiency, cost, and carbon footprint of the synthesis gas production based on the simulation results.