Techno-economic evaluation for direct hydrogenation of CO_2 to alkene-range hydrocarbons

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Global warming and the depletion of fossil fuels motivate the investigations of CO_2 hydrogenation to high-value chemicals such as methanol, synthetic natural gas, hydrocarbons. The present work describes the development of new process models utilizing environmentally harmful CO_2 as raw material for hydrocarbon products comprised of integrated facilities of synthesis and separation processes using Aspen Plus. On the basis of process flowsheets, we evaluated and compared the proposed processes in terms of technical performance (i.e., CO_2 conversion, energy efficiency) and economic analysis (i.e., minimum selling price - MSP). As a result, we discussed the optimal process configuration among the proposed scenarios. Furthermore, we analyzed the economic sensitivity to identify major cost-drivers and debottleneck solutions. In addition, we examined alternative scenarios to find the most optimistic conditions for the lowest MSP.