Optimization of CO_2 Conversion Process for Methanol Production via Combined Reforming of Methane for minimizing CO_2 emission

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Utilization of CO_2 as a feedstock to produce valuable chemical products is attracting much attention in recent studies. The goal of this work is to minimize a net CO_2 emission index (kg_{CO2}/ton_{MeOH}) of a sustainable CO_2 conversion process producing methanol via combined reforming of methane reaction which is considered as a prime candidate for commercialization. The process flowsheet of the baseline process is developed using Aspen Plus®, the commercial process simulator. The feedstock ratio and reforming conditions are chosen as the key process design variables. Sensitivity analysis is used to investigate how their changes influence on CO_2 emission flows of the overall process. The optimal values of the four design variables are decided by generating the 2-dimensional equilibrated syngas plot which represents the feasible operating region in consideration of several physical constraints. As a result, 16.3 % reduction of net CO_2 emission as well as 7.85 % saving of the operating cost has been achieved with respect to the conventional methanol production.