Selection of suitable feedstocks for dimethyl ether production based on CO_2 utilization

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Utilization of carbon dioxide, a major greenhouse gas, as a feedstock for production of useful chemicals/fuels is an interesting topic nowadays. In this study, dimethyl ether (DME) is considered as it is an alternative green fuel having properties near liquefied petroleum gas (LPG). A typical production process consists of two major reactions steps; i.e. 1) methanol synthesis from carbon dioxide and hydrogen and 2) DME synthesis from methanol. The successful implementation of carbon dioxide utilization concept to DME production relies significantly on the source of hydrogen. Hydrogen from electrolysis of water using electrical power from solar cells is an ideal feed which does not cause additional carbon dioxide emission to atmosphere. However, it has not yet applied in industrial operation due to its high capital cost. In this work, alternative processes for hydrogen production are considered. Various feedstocks (biomass, biogas and natural gas) and hydrogen production technologies (gasification, stream reforming, partial oxidation and autothermal reforming) are evaluated using ASPEN PLUS software to simulate the performance of different integrated processes of hydrogen production and the DME production. It is aimed at finding suitable feedstock and hydrogen production technology to achieve the DME production process with maximum utilization of carbon dioxide.

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