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Methanol Steam Reforming with Heat Recovery for Hydrogen-Rich Gas Production

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Abstract : This study is to develop a methanol steam reformer with a heat recovery zone, which recovers heat from exhaust gas of a diesel engine, and to investigate waste heat recovery ratio at the required reaction temperature. The operation conditions of the reformer are reaction temperature (200 °C, 250 °C, and 300 °C), steam to carbonate (S/C) ratio (0.9, 1.1, and 1.3), and N2 volume flow rate (40 cm3/min, 70 cm3/min, and 100 cm3/min). Finally, the hydrogen concentration, the CO, CO2, and N2 concentrations are measured and recorded to calculate methanol conversion efficiency, hydrogen flow rate, and assisting combustion gas and impeding combustion gas ratio. The heat source of this reformer comes from electric heater and waste heat of exhaust gas from diesel engines. The objective is to recover waste heat from the engine and to make more uniform temperature distribution within the reformer. It is beneficial for the reformer to enhance the methanol conversion efficiency and hydrogen-rich gas production. Experimental results show that the highest hydrogen flow rate exists at N2 of the volume rate 40 cm3/min and reforming reaction temperature of 300 °C and the value is 19.6 l/min. With the electric heater and heat recovery from exhaust gas, the maximum heat recovery ratio is 13.18 % occurring at water-methanol (S/C) ratio of 1.3 and the reforming reaction temperature of 300 °C.

Keywords : heat recovery, hydrogen-rich production, methanol steam reformer, methanol conversion efficiency
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