Dry Methane Reforming Process

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A. Background

Methane is used petrochemical industries as a precursor for the production of high quality hydrogen. This is usually done by steam reforming where steam is reacted with methane to form Carbon monoxide and Hydrogen. The dry reforming of methane is a similar process where methane is reacted with Carbon dioxide instead of steam to produce hydrogen and Carbon monoxide (syngas). This process is usually favoured at low temperatures and high pressures. Dry reforming of methane is environmentally very attractive as it utilizes two greenhouse gases to give a useful product

B. Flowsheet description

Two feed streams containing Methane and Carbon dioxide respectively are sent into the mixer. The feed streams are at same conditions of 1 atm and 50 C with a molar flow rate of 1000 kmol/h. The mixed stream is then sent to a heater where it is heated to 1100K. The heated stream is then sent to an equilibrium reactor where the conversion is given at 94% for the given temperature. The product which is syngas with little amount reactants is then cooled using a cooler. The energy generated from cooling the stream is recycled and used by the heater to heat the reactant stream. This flowsheet is based on Luyben (2014).

C. Results and Discussions

Syngas of required quality within tolerable limits was produced by simulation of dry methane reforming using DWSIM version 5.1. The results are tabulated below

Master Property Table				
Object	Product	Methane	Carbon-di-oxide	
Temperature	1100	323.15	323.15	K
Pressure	101325	101325	101325	Pa
Mass Flow	16.681055	4.4563889	12.224861	kg/s
Molar Fraction (Mixture) / Methane	0.013072569	1	0	
Molar Fraction (Mixture) / Hydrogen	0.48692743	0	0	
Molar Fraction (Mixture) / Carbon monoxide	0.48692743	0	0	
Molar Fraction (Mixture) / Carbon dioxide	0.013072567	0	1	
Molar Fraction (Mixture) / Water	0	0	0	

D. References

Luyben W. L. (2014), Design and Control of the Dry Methane Reforming Process, *Industrial and Engineering Chemistry Research*, 53, 14423−14439.