

Dimethyl Ether Production

- Flowsheeting - Figures. Timestamps
- Physical Property Environment - Binary Parameters
- Design Specs
- Units - CSTR, Compress, Flash

Problem Statement

- Dimethyl ether $\text{CH}_3\text{-O-CH}_3$, is to be produced from CO_2 & H_2 . Initially there is formation of $\text{CO} + \text{H}_2\text{O}$, which is then converted to Methanol and simultaneously to dimethyl ether.
 - This is done in two reactors, stirred tank, at isothermal conditions. No pressure Drop
 - Feed is initially 1:3 ratio $\text{CO}_2\text{:H}_2$ at 25°C , $P = 1$ bar
 - The First reactor is operated at 50 bar, 400°C , since CO and H_2O must be favored
 - The second reactor is operated at 50bar, 227°C , since methanol \rightarrow dimethyl ether is required. Note that the second reactor must have a very low content of water, for which a Flash at very cold conditions must be used to separate liquid humidity.
 - No more than 0.20 kmol/h of Methanol must be lost in the purge/stack
 - The degasser must recover most of the liquid materials (water, methanol and dimethyl ether)
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- There is a special equipment which will recover most of non-polar substances in the streams (DIM-Trap)
 - The dimethyl will be recovered this way
 - All other material, methanol-water mix must be sent to a distillation column
 - NOTE \rightarrow Try using DSTWU at home
 - Reaction equilibrium (Arrhenius) data is to be supplied later.
 - USE of Design Specification is REQUIRED

Design Methodology

- (A) Run CSTR1, verify results
- (B) Use Design Spec For Water flow rate
- (C) Verify Reactor 2 , ensure Dimethyl production
- (D) Add Recycling & Purge → Design Spec for Degaser
- (E) Separate final products DIM-trap & Send to plant