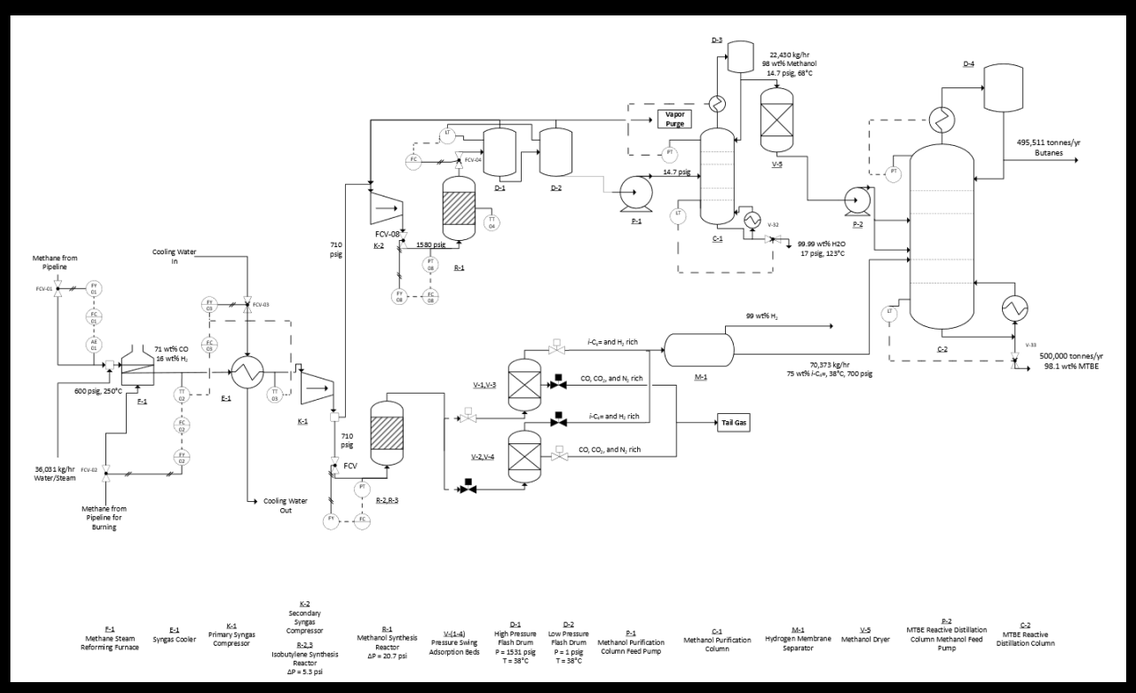
SENIOR DESIGN PROJECT – DESIGN, ANALYSIS, AND OPTIMIZATION OF AN MTBE PRODUCTION FACITLIY

Team Members: Rohan Dighe, Chandani Patel (M.S. at Purdue), Tim Porsche (M.D. at Indiana University), Takashi Yokokura (PhD at UC Berkeley)

Awards: 1st Prize out of 33 Senior Design submissions in Spring 2020



Task: Choose a fuel oxygenate (fuel additives commonly used to reduce emissions and increase engine performance) and design/optimize a process to produce the oxygenate using shale ethane/methane feedstock

Approach: MTBE has large existing market share and favorable physical properties. Reactive precursors (methanol, isobutylene) can be readily synthesized from light hydrocarbons. Thus, design a process to produce MTBE.

Rohan's Contributions:

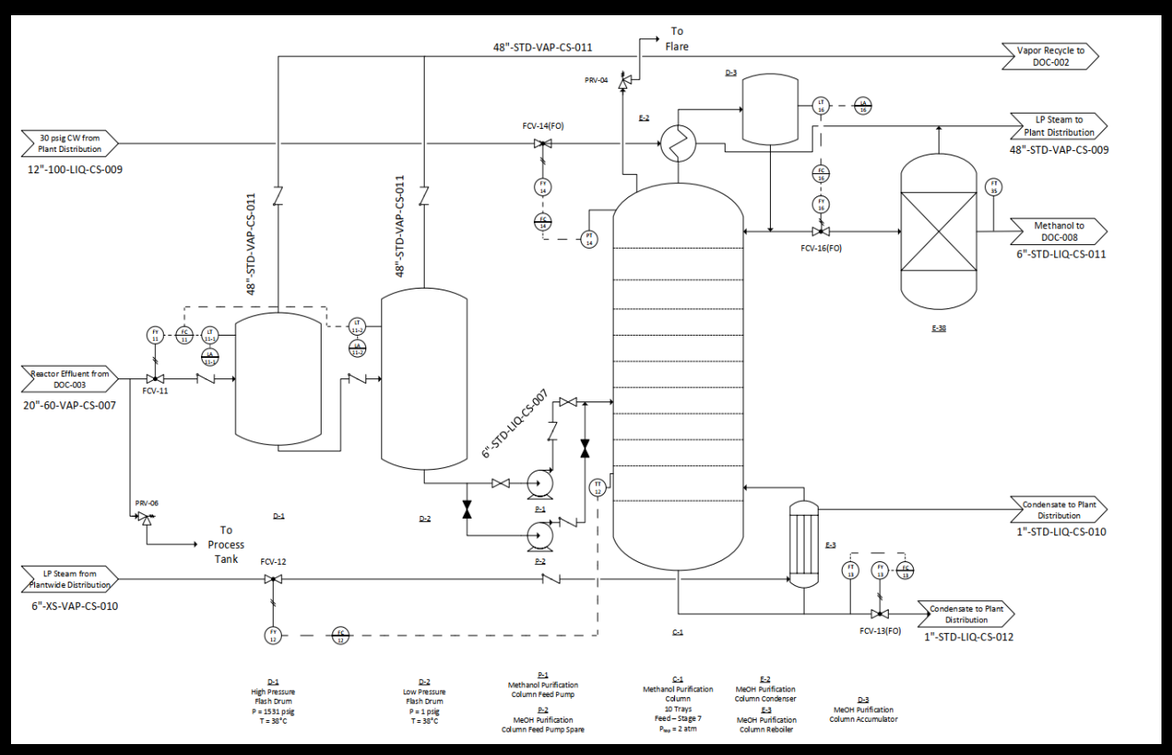
Process Synthesis – With kinetic and reaction pathway information obtained from teammates, I was able to devise a process to synthesize isobutylene and methanol by way of syngas (obtained via steam methane reforming) and to then produce MTBE via reactive distillation

Process Modeling – Using Aspen Plus, I modeled all unit operations (with rigorous kinetics, where applicable).

Process Optimization – With help from teammates working on process economics, I was able to apply sensitivity analyses to annual cost optimizations and develop a highly economical process

Equipment Design and Costing – Conducted all preliminary equipment design and costing (basic level) using Aspen Economics and by hand with existing cost and sizing correlations

Control Systems, Piping, and Instrumentation – Designed all control systems and used ChE resources (Perry's Handbook , Lee's Guide) to determine appropriate pipe specifications for each line in the process. I also developed P&IDs for every unit operation



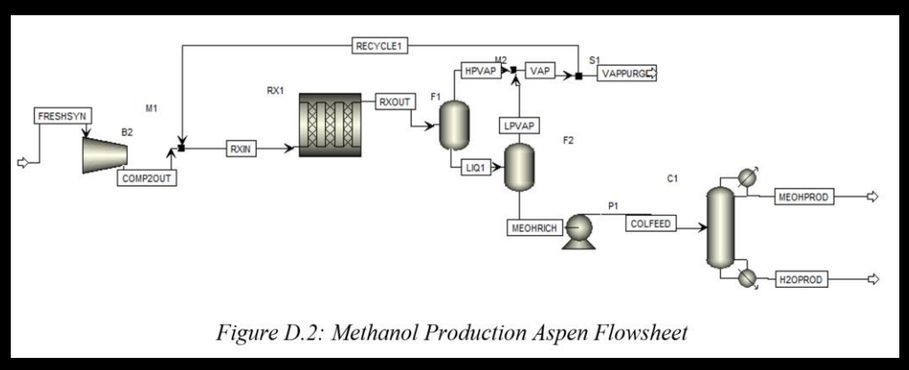
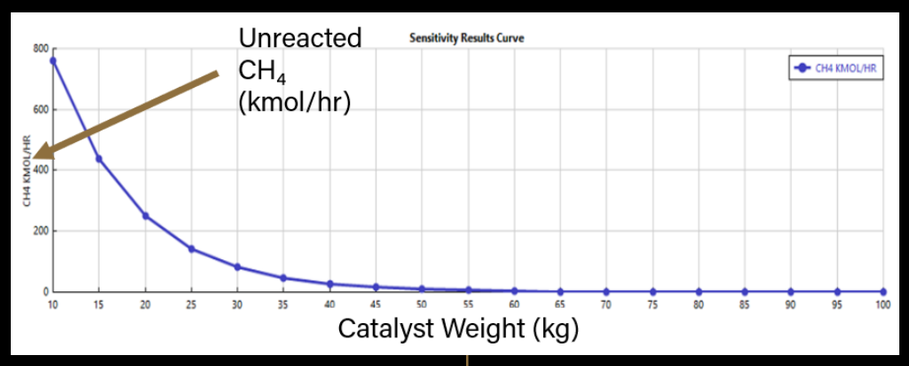


Figure D.2: Methanol Production Aspen Flowsheet



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